DECEMBER, 1936

HEATING AND VENTILATING

DEC 19 1936
ENGINEERING LIBRARY

INCLUDING AIR CONDITIONING — PIPING — REFRIGERATION — AIR SANITATION

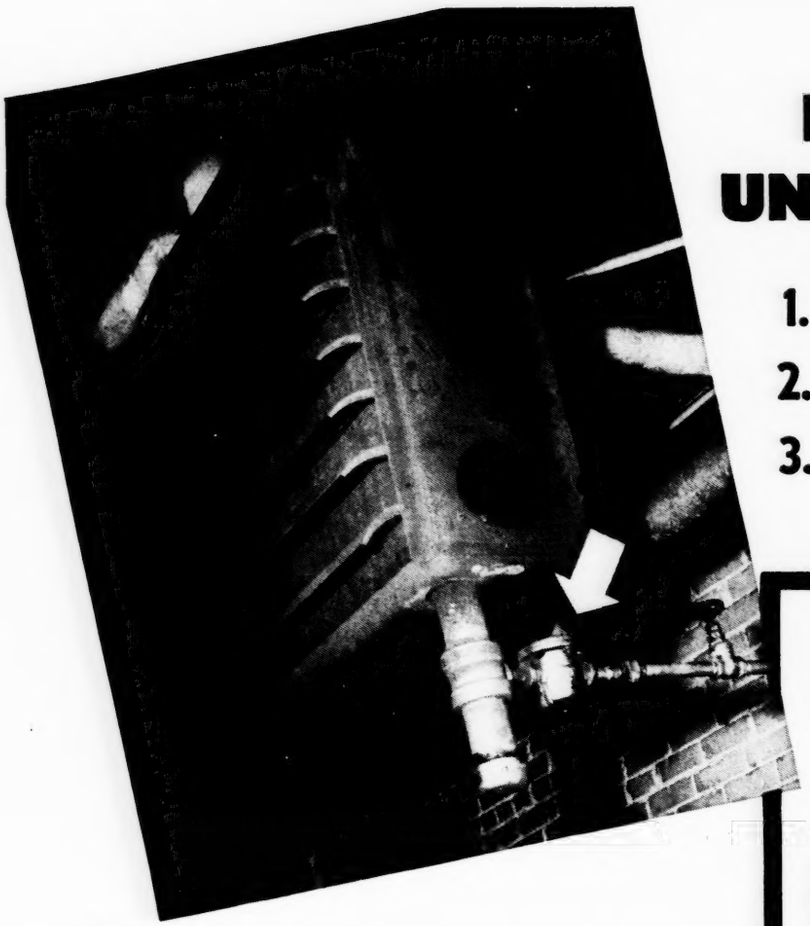
Air Conditioning Churches . page 59

Sizing Cyclone Dust Collectors . page 63

Warm Air Heating for Schools . . . page 67

Errors Often Made in Hot Water Systems . page 70

Table of Contents . . . page 3



HOW TO SELECT UNIT HEATER TRAPS

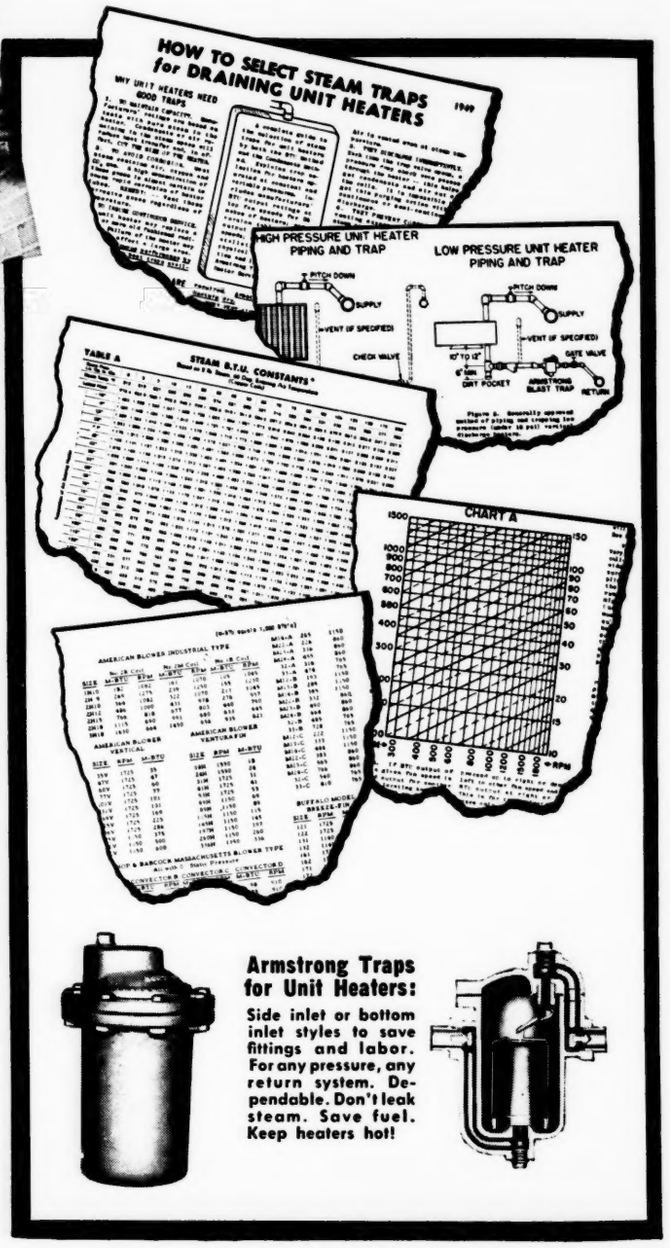
1. To obtain full BTU output
2. To insure continuous service
3. To avoid corrosion

THE ANSWERS are in a new 8-page handbook prepared by Armstrong! Only thing of its kind, this manual explains why it is important to use dependable traps that are properly sized and that will discharge condensate and corrosive incondensable gases at steam temperature; tells how to select traps by the BTU Method and the Condensate Weight Method; includes tables of BTU outputs of the heaters produced by 24 different manufacturers; discusses heater manufacturers' recommendations on types of traps to use and methods of installation; and includes tables and charts for working trap selection problems.

Anyone is welcome to a copy of this helpful guide to better unit heater performance. Address your request to:

ARMSTRONG MACHINE WORKS

846 Maple St., Three Rivers, Michigan


HOW TO SELECT STEAM TRAPS for DRAINING UNIT HEATERS
HIGH PRESSURE UNIT HEATER PIPING AND TRAP
LOW PRESSURE UNIT HEATER PIPING AND TRAP
TABLE A
STEAM B.T.U. CONSTANTS
CHART A
Armstrong Traps for Unit Heaters:
Side inlet or bottom inlet styles to save fittings and labor. For any pressure, any return system. Dependable. Don't leak steam. Save fuel. Keep heaters hot!

ARMSTRONG STEAM TRAPS

Over a Million in Use...For Power...Process...Heating

HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

Member, Audit Bureau of Circulations.

Editorial Staff

Editor
CLIFFORD STROCK

Associate Editors
NATHAN N. WOLPERT
WILLIAM B. FOXHALL

Technical Consultant
T. W. Reynolds

Advertising Staff

Chicago
GEORGE G. TURNER
228 North La Salle Street.

New York
HARRY J. TWINE
148 Lafayette Street.

Cleveland
EDWARD B. McENTEE
17115 Hillsboro Road.

Los Angeles
ROBERT H. DEIBLER
2506 W. 8th Street.

Published by

THE INDUSTRIAL PRESS
148 Lafayette Street
New York 13, N. Y.

President
ROBERT B. LUCHARS

Vice-President and Treasurer
EDGAR A. BECKER

Secretary and Publishing Manager
HAROLD L. GRAY

Subscription Rates

Yearly subscription in the United States and Canada, one year, $3; two years, $5; three years, $6; in all other countries, $5 per year. Single copies 30 cents. Entered as second-class matter, April 18, 1925, at the Post Office, New York, N. Y., under the act of March 3, 1879.

CONTENTS FOR DECEMBER, 1950

VOLUME 47 **NUMBER 12**

ARTICLES

Air Conditioning of Churches 59
M. J. Williams

Graphical Method of Sizing Cyclone Dust Collectors 63
L. Monroe

Warm Air Heating for Schools 67
F. W. Osborn

Errors Often Made in Forced Hot Water Heating Systems 70
T. W. Reynolds

Ventilating the 200-Seat Theater 76
J. J. Sefing

If I Were an Advertising Man 78
H. Terry

Scrapbook of Exhaust Hood Design—Part 6 79
J. M. Kane

Methods for Supporting Pipe—Part 8 81

REFERENCE MATERIAL

Section—Moisture Condensation on Enclosed Show Windows .. 83
T. L. Gershun

Data Sheet — Air Conditioning Design Conditions — Industrial Plants ..... Opposite 126

DEPARTMENTS

Washington News—*Loring F. Overman* 53
Briefly Stated 56
News of Equipment and Materials 95
New Catalogs ..... Opposite 102
Product Applications 103
Experience is My Classroom—*T. W. Reynolds* 105
Abstracts and Reviews 106
Coming Events 109
Degree-Days for October, 1950 110
News of the Month 114
Getting Personal 123
Canadian Degree-Days for September and October, 1950 123
Industrial Degree-Days for September and October, 1950 124

The contents of HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and by Engineering Index.

Copyright, 1950, by The Industrial Press

PUBLISHERS OF MACHINERY & MACHINERY'S HANDBOOK
The INDUSTRIAL PRESS

THIS MONTH'S COVER

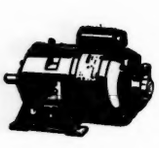
Show windows provide an important factor in merchandise sales. It is important, therefore, that displays be visible at all times and not obstructed by moisture condensing on the glass. For details of systems to prevent condensation, see page 83.

"**Design simplicity** is the biggest advantage we get by using standardized fractional-hp motors," says R. A. Preston, chief design engineer with theTecumseh Products Company. "By adhering to these standards, we can often eliminate costly construction details. It's easier to select the exact motor we need, too, when we know *in advance* what the motor characteristics are."

"**Customer satisfaction** is an asset we prize very highly," says H. S. Mulhollen, vice president and general sales manager of the Essick Manufacturing Company. "One way we keep our customers satisfied is to give our distributors a workable motor exchange and service plan, something we can do effectively by using standardized fractional-hp motors on our products."

STANDARDIZATION can make

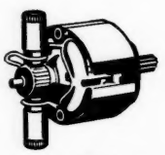
STANDARDIZED FRACTIONAL HORSEPOWER MOTORS



Gear-Motors

Home Laundry

Sump Pump



Series Motors

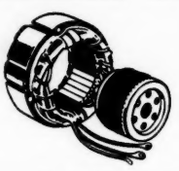
Shaft-Mounted Fan

General Purpose

Jet Pump

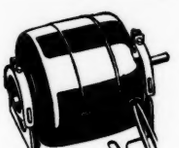
Belted Fan

Gas Pump



Hermetic Refrigeration

Oil Burner



Unit-Bearing Fan

Want experienced application engineering help in using these and other G-E standardized motors? It's yours for the asking!

Washington News

LORING F. OVERMAN

WHEN officials of the Defense Department and the National Security Resources Board invited some 90 representatives of industry, labor, agriculture and the public to meet in closed session in Washington November 30, pressrooms began to hum with speculation. Although announced as an off-the-record meeting, the invitations revealed that guests would hear details of the four-year program which Defense Secretary George C. Marshall and his staffs are developing to rearm the United States.

Despite the hush-hush as to details, Washington was convinced that the meeting would mark the end of the voluntary defense program and the beginning of one in which the big stick of controlled production will be wielded with a vengeance.

Straws Point

Everything going on in Washington indicates that those at the helm are thinking in terms of considerably more military production than the public has cared to think about. In trial-balloon speeches throughout the country, government spokesmen are giving folks an interesting preview of "$50 to $60 billion a year defense programs," "three million men under arms by June," and "likelihood of a new Controlled Materials Plan for scarce materials" if either of the foregoing programs develops.

Most vocal of the National Production Authority spokesmen is Manly Fleischmann, NPA's general counsel. At news conferences and several semi-public meetings, Mr. Fleischmann observed that "A controlled materials plan will have to be set up by midsummer if Congress appropriates $50 or $60 billion for defense." Mr. Fleischmann said that the single band priorities system now in effect under NPA Regulations is suitable for present needs, but only to assure that the military will get what it needs, and on time.

Mr. Fleischmann pointed out that the projected $50 to $60 billion military expenditures, if realized, would approximate those of World War II, when it became necessary to allocate every pound of steel, copper and aluminum in order to meet military and essential civilian requirements.

End in Sight

Already it is apparent that there is not enough of the scarce materials to go around, even with the defense program barely started; NPA order M-7 reduces civilian consumption of aluminum by 30%, effective January 1, while Order M-3 provided that only an order bearing a military DO rating can claim delivery of columbium-bearing steel. NPA pulled back on an order freezing cobalt and threatening to limit civilian deliveries stringently. Zinc, copper, manganese, tungsten, lead, tin, and cadmium were other metals being eyed by the controls writers. Issuance is only a matter of time.

Construction Ban Tightened

While it was not believed in Washington that the piecemeal approach to the controls problem could long withstand the threat of a $50 to $60 billion program, efforts to plug leaks and take up the slack continued. On November 14 the NPA order banning amusement construction (M-4) was expanded to include "bars and buildings or structures where the predominant business was the sale of alcoholic beverages." Previously, NPA had banned the construction of night clubs, game courts, swimming pools and a long list of other recreational facilities.

Despite NPA efforts to cut down building totals, joint estimates of the Departments of Commerce and Labor indicated that the 1951 total would be only about $4.1 billion below the all-time record of $27.4 billion estimated for 1950. The foregoing estimated 15% drop is made on the assumption there will be no all-out third world war.

It is expected that residential construction will bear the brunt of the drop, with starts dropping from 1.4 million to 850,000 or less. Expenditures for the year are expected to drop from $12.6 billion (1950) to $8.4 billion next year.

Recreational and amusement building will be off, of course, but starts will carry some $150 million into 1951, as compared with $350 million this year.

Commercial construction may come in for restriction soon, but in the meantime starts are being made feverishly and a total of $1 billion is considered likely if controls are applied, or $1.5 billion without. Total for 1950 is estimated at $1.3 billion.

Industrial building is expected to jump sharply from an estimated $1,280 million this year to $1,850 million in 1951. Industry is being pressured by government to increase both steel and aluminum capacity.

Educational facilities, particularly below the college level, are greatly behind needs, and a record high of $1.5 billion is forecast for 1951.

Hospital construction, while continuing high, is expected to be about $150 million below 1950's record $800 million. Expenditures on veterans' hospitals are expected to level off at about the same as 1950. Completion of 22 this year and next is anticipated, leaving 17 of the total program of 66 for completion after 1952. Five had been completed before January 1, 1950.

Public types of buildings and construction are expected to account for expenditures of $7 billion in 1951, slightly more than in 1950.

Military and naval construction is also to rise next year as the number of men in training expands. Because of carryover facilities from World War II, however, it is not anticipated that the total for the year will exceed $200 million.

Expansion Loan Rules

Rules for granting direct loans by the Reconstruction Finance Corporation for plant expansion needed

WORKABILITY DEPENDS ON GOOD GALVANIZING

Forming a galvanized sheet under shop conditions will usually give a good indication of its all-around workability. The coating on Bethlehem Galvanized Sheets withstands ordinary forming and bending operations in a satisfactory manner.

Careful mill practice is followed to maintain uniform quality of the coating. Close control of preparation and hot-dipping insures excellent bonding of zinc to the steel and minimizes any tendency to scale or flake.

When greater-than-ordinary resistance to corrosion is needed, these sheets can be furnished with a base of copper-bearing steel.

Besides their lasting quality, Bethlehem galvanized sheets have the strength and rigidity required for top-grade sheet-metal installations. They are easy to handle, cut, form, seam and solder, making fast work of ducts, hoods, ventilators, special tanks or other difficult jobs.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM GALVANIZED SHEETS

to accelerate the rearmament program, have been issued by the National Securities Resources Board. Forms upon which applications for loans may be filed are also available.

The Defense Production Act provided a $2 billion loan authorization and a $600 million revolving fund for loans to business for plant expansion needed to support the defense effort. In order to apply for such a loan, the plant requesting the financing must secure a certificate from the Army, Navy, Air Force, Interior or Agriculture Department or the Defense Transport Administration. The certificate must indicate that the loan is necessary to expedite production and deliveries or services to aid in carrying out government contracts for the procurement of materials or the performance of services for the national defense.

Claimant Agencies Expanded

A new Department of Commerce Order No. 127 expands the list of government agencies authorized to make claims for scarce materials under National Production Authority procedures. The original list of 11, which were authorized to act as claimant agencies, has been expanded or subdivided to include 19 names. Jurisdiction of each is carefully defined under the new order, which implements Executive Order 10161.

The original list included merely the Departments of Defense, Agriculture, Commerce and Interior, and the Economic Cooperation Administration, Atomic Energy Commission, Interstate Commerce Commission, Housing and Home Financing Agency, and State Department.

The new order reflects the Commerce Department's effort to determine needs of segments of the economy other than the military. Thus the order seeks to balance available supplies between military, defense-supporting industries, and civilian economy. Inclusion of agencies concerned principally with civilian activities indicates that an early attempt will be made to draw a line between essential and less essential activities.

The order also gives weight to the assumption that it will not be long before the present semi-voluntary system of distributing scarce materials will give way to rulings with more teeth in them. For the moment, however, industries having difficulty getting materials or repair and operating supplies, may turn for help to the agencies assigned to represent them. The assignments are as follows:

Agriculture will be the claimant agency for foods, farm equipment, commercial fertilizer, and veterinary supplies.

Defense Department will handle all claims of the military except for items which General Services Administration is the regular buying agent. Defense Department will also handle claims for military equipment and supplies for mutual aid defense programs, stockpiling, and military construction.

Defense Transport Administration will handle domestic transportation, storage, and port facilities.

Interior Department, under the new order, will claim materials pertaining to petroleum, gas, solid fuels, electric power, construction and maintenance projects under its jurisdiction; fishery projects as understood in agreements between Interior and Agriculture; metals and minerals through the refinery or smelting process, except in the case of ferrous products; and the construction program of the Tennessee Valley Authority.

The new order also names six subdivisions of the Department of Commerce as claimants. Office of International Trade is claimant with respect to all exports not covered by the Defense Department and ECA. Maritime Commission is claimant with respect to coastwise, intercoastal and overseas shipping and merchant ship construction and repair. Civil Aeronautics Board acts for all aircraft used in air carrier transportation. Civil Aeronautics Administration for all other civil aviation operations, and Commissioner of Public Roads for all highway construction and maintenance. In this connection he is instructed to consult with the Department of Agriculture and the Housing and Home Finance Agency on road problems within their jurisdictions.

The NPA Administrator in charge of Industry Operations, H. B. McCoy, is named as claimant with respect to the needs of all industries and business, including wholesale and retail trades, and the construction and service industries not otherwise covered.

Other agencies include the Atomic Energy Commission; Federal Communications Commission with respect to all communications facilities; Director of the National Advisory Committee for Aeronautics; Housing and Home Finance Agency, with respect to housing construction, alterations and repair, and community facilities other than those handled by the Federal Security Administration; Federal Security Administration with respect to hospitals and schools other than veterans' hospitals; and Veterans Administration with respect to the VA hospital program.

The General Services Administration gets jurisdictions "with respect to the needs of all federal government agencies not otherwise covered, including federal construction not otherwise covered, and, nothwithstanding other designations made, the needs of all Federal Government Agencies for common-use items listed in the General Services Administration Stores Stock Catalog, or procured under Federal Supply Schedule contractions, or otherwise designated as common-use items by the Administrator of General Services—provided that the Secretary of Defense shall act as claimant with respect to the needs of the Department of Defense for such common-use items as may be designated by agreement."

The civil functions of the Army are noted under the new order, which designates the Secretary of the Army to act as claimant for civil functions coming within the jurisdiction of the Corps of Army Engineers. The Army would not handle, without specific authorization, projects involving electric power generating capacity unless specifically exempted by the Secretary of the Interior, who customarily handles power under the defense program.

ECA, final claimant agency named in the new order, will claim materials for all nonmilitary exports to countries in which ECA has programs, including requirements for additional military production under the Mutual Defense Aid Program.

BRIEFLY STATED

• An outstanding industrial merger of recent months involves three companies widely known as manufacturers of power plant equipment. These are C. H. Wheeler Manufacturing Co. of Philadelphia, and Economy Pumps, Inc. and Klipfel Valves, Inc., both of Hamilton, Ohio. Announcement of the merger was made by L. G. L. Thomas, president of the three companies. No change at the present time in personnel or operation of any of the companies is planned.

• Charles R. Holzworth, who has been vice president and general manager of the Tonawanda Iron Division of the American Radiator & Standard Sanitary Corp., has been made president of the division. Mr. Holzworth succeeds B. S. Stephenson, who retired on the company's retirement plan.

• Texas Gas Transmission Corp. earned $1,021,000 during the third quarter of 1950, or 46 cents per share, after reflecting the recent increase in federal income tax rates. Net income for the pipe line company, for the nine months ended September 30, 1950, was $2,898,000, equal to $1.30 per share.

• The Holland-American Line has awarded a contract to air condition its two new 15,000-ton liners, the Ryndam and the Maasdam, to the Netherlands distributor of Carrier Corporation of Syracuse, N. Y. Public rooms of both vessels will be serviced by conventional air distribution systems, with cooling furnished by Carrier centrifugal compressors.

• Five nominations to the ASHVE Committee on Research, which directs the society's research program at its laboratory in Cleveland, Ohio, and at cooperating universities and colleges, have been announced. If elected by the ASHVE membership, the men will serve for three years, succeeding those members whose present terms expire January, 1951. Named by the Council, governing body of the society, the nominees are: Prof. A. B. Algren, head, Division of Heating, Ventilating, Air Conditioning and Refrigeration, Department of Mechanical Engineering, University of Minnesota; John Everetts, Jr., consulting engineer; Charles S. Leopold, Phila.; T. H. Smoot, director of research, The Lennox Furnace Co., Marshalltown, Ia.; T. A. Walters, director of research, American Blower Corp., Detroit; and W. N. Witheridge, ventilation consultant, General Motors Corp., Detroit.

• New construction activity turned downward in October from the record rate which it had maintained through the summer, the U. S. Labor Department's Bureau of Labor Statistics and the Construction Division, U. S. Department of Commerce reported. The total value of all types of new construction put in place during October amounted to about $2.7 billion, 4% less than the September total, but 24% higher than the October, 1949, figure.

• The nomination of Lauren E. Seeley, dean of the College of Technology and director of the Engineering Experiment Station, University of New Hampshire, Durham, N. H., for president of ASHVE in 1951 has been announced. Nominees for other offices submitted by the ASHVE nominating committee are: First vice president, Ernest Szekely, president of the Bayley Blower Co., Milwaukee, Wis.; second vice president, Reg F. Taylor, consulting engineer of Houston, Tex.; treasurer, Howard E. Sproull, division sales manager, American Blower Corp., Cincinnati, Ohio.

• A broad program to bring scientific research to bear on the nation's housing problems will be conducted by a new Housing Research Center at Cornell University equipped to study questions ranging from housing technology to the influence of human behavior on shelter requirements. The program will be directed by Glenn H. Beyer, professor of housing and design.

• Public recognition to the three men principally responsible for the development of the Freon family of refrigerants was made by the American Society of Refrigerating Engineers during the 46th Annual Meeting of the Society in New York City, December 3 to 6. A "Certificate of Recognition" was presented to Thomas Midgley, Jr., posthumously, and to Dr. Albert L. Henne and Robert R. McNary on Tuesday evening, December 5, at the Hotel Commodore in New York.

• Total sales of gas by utilities to ultimate customers in September, 1950, were 2.8 million therms, an increase of 6.7% over the amount sold in September, 1949, the American Gas Association reported. For the 12 months ended September 30, 1950, total sales of gas showed a gain of 14.4% over the comparable period a year earlier. The Association's index of gas sales for September, 1950, was 254.0% of the 1935-1939 average.

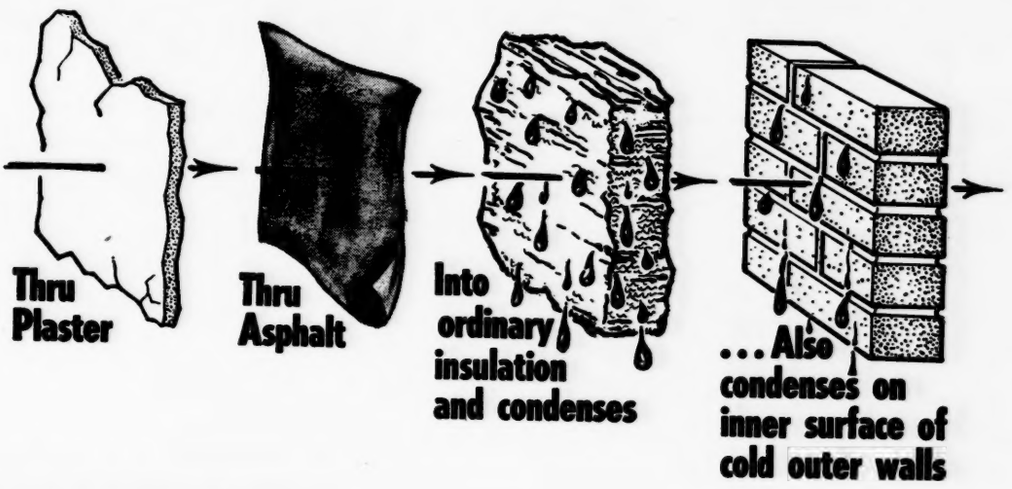
• Appointment of C. E. Buchholzer as president of the Airtemp Division, Chrysler Corp., Dayton, Ohio, was recently announced. Buchholzer succeeds W. C. Newberg who has been made vice president and director of the corporation's Dodge Division in Detroit. A native of Dayton, Mr. Buchholzer has been with Airtemp for 14 years. He joined the division in 1936 as a job setter.

• Nearly 300 executives of the refrigeration industry, representing the members of the Refrigeration Equipment Manufacturers Association and the members of the Refrigeration Equipment Wholesalers Association, gathered at The Greenbrier, White Sulphur Springs, West Virginia, on November 2, 3, and 4, for a joint membership meeting.

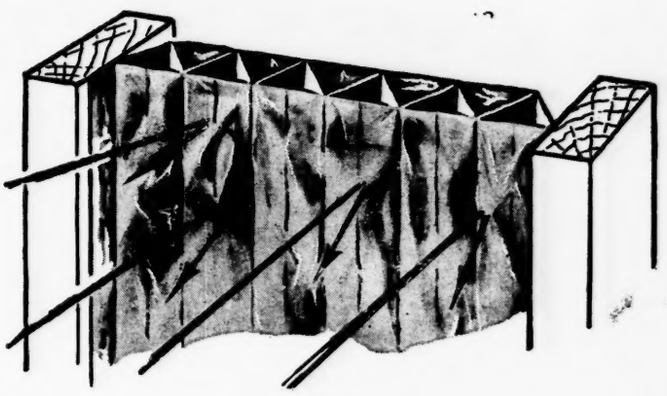
• Employment at Minneapolis-Honeywell Regulator Co. has reached 15,500 persons, a new high for the company. Previous peak was 14,000 employees, reached during the last war.

• W. V. Davidson, Jr., has been elected executive vice president of the W. B. Connor Engineering Corp.

Vapor Flows



Vapor does not flow thru nor condense on outer or inner surfaces or reflective air spaces of multiple sheet accordion aluminum.



Water vapor is a gas. At 32° its density is 1/200,000th that of water so that it can sieve through asphalt, plaster, and most other building materials. Cold ordinary insulation and cold outer walls, below the dewpoint temperature of the vapor, cause it to condense.

Tough aluminum is impervious to water vapor and yet has insufficient mass to extract heat from contacting air before reaching equilibrium in temperature with it. Colder air can support less vapor, and is an important cause of condensation.

In addition, multiple accordion aluminum repels 97% of heat rays, emits only 3%, and is also an excellent block to conduction and convection. This construction is commercially available as Infra Insulation Type 4 and Type 6, costing less than 7½¢ and 9¢ sq. ft. respectively, material with labor, installed between wood joists in new construction.

"Simplified Physics of Vapor and Thermal Insulation," an authoritative and simply written brochure which has proved of value to architects, engineers, builders and contractors, teachers and officials, may be obtained free by filling out the coupon below.

THERMAL FACTORS, TYPE 4 INFRA

Down-Heat C.064, R15.62 equals 5" DRY Rockwool
Up-Heat C.109, R 9.17 equals 3" DRY Rockwool
Wall-Heat C.105, R 9.52 equals 3 1/7" DRY Rockwool

VAPOR PERMEABILITY equals ZERO

INFRA INSULATION, INC.
10 Murray Street New York, N. Y.
Telephone: COrtlandt 7-3833

INFRA INSULATION, INC.
10 Murray Street, New York, N. Y. Dept. V-12

Please send "Simplified Physics of Vapor and Thermal Insulation."

Name_____

Firm_____

Address_____

☐ Send Prices of Infra Insulations ☐ Send Sample

MAXIMUM EFFICIENCY FOR STEAM HEATING SYSTEMS ON HEATING, DRYING AND PROCESS WORK.

JENNINGS CONDENSATION PUMPS

Designed for steam systems on heating, drying, or process work, these pumps offer the most reliable and efficient means of returning hot condensate to boiler or hot well. In many cases these pumps will save costly installation of boilers in a pit to provide gravity flow of returns from basement radiators and heating devices.

The Jennings Condensation Pumps are sturdy and compact in construction, and combine receiving tank, pump and driving motor in a single assembly. Pumps are bronze fitted throughout, with tobin bronze shaft. The pumping impeller is of special design, made possible by our wide experience with return line heating pumps, and is especially adapted for handling hot water with the greatest possible efficiency.

Full automatic control is furnished by means of a ball float and float switch mechanism mounted on the receiving tank. All wiring is made up at the factory, and it is necessary only to connect the pump to the system and hook up the leads. Complete information regarding these economical pumps sent promptly on request.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

Air Conditioning for Churches

M. J. WILLIAMS
The Trane Co., LaCrosse, Wis.

Air conditioning is no longer regarded as a luxury by many churches faced with curtailed summer attendance. Special design problems and equipment types are discussed.

CHURCH organizations are beginning to realize that summer comfort is as essential as winter comfort if attendance is to be maintained during the hot months. Many churches are coping with this situation by installing summer-winter air conditioning systems, not only for their sanctuaries, but also in the Sunday school rooms. These churches have been remarkably successful in maintaining their average attendance the year around. Church boards, therefore, may look at air conditioning as a business investment, and will see what can be done to provide some degree of comfort at the least possible cost.

First cost and operating cost of summer air conditioning will be affected by geographic location. For instance, in some northern states well water and even city water may be available at from 52F to 56F, cold enough to maintain indoor conditions of 80F and relative humidities of 55% to 60%, the upper range of summer comfort conditions. The equipment required for this type of system would be a factory-built unit using a blower fan, motor and drive, water coil and filters, as shown in Fig. 1.

Where this low temperature water is not available, mechanical refrigeration must be used. This would generally require a compressor, direct expansion coils, and an evaporative condenser where conservation of water is desirable. The initial cost of this system, shown in Fig. 2, would naturally be higher.

In still other localities where the average outdoor summer conditions are relatively dry (say, at dew point temperatures below 60F) fairly comfortable indoor conditions may be provided by evaporative cooling. The equipment in this case would consist of either a factory assembled unit or a built-up unit, depending on the size of the system. It would use a blower fan, motor and drive, sprayed filters, water cir-

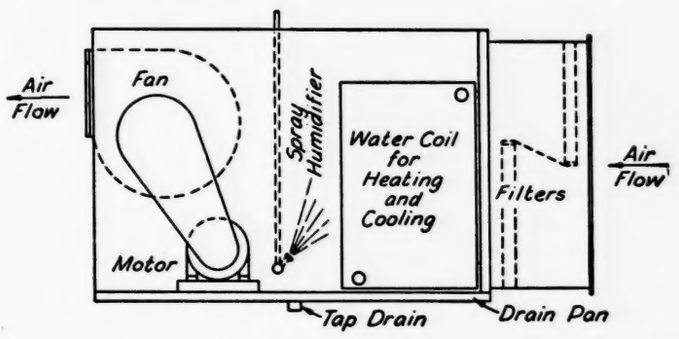


Fig. 1. Climate changer with water coil.

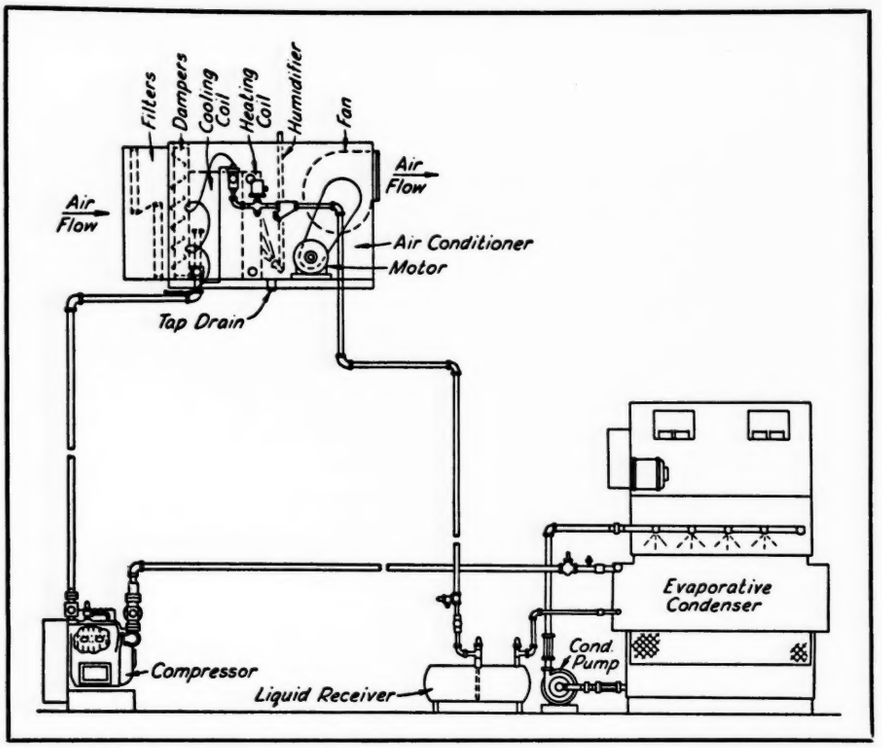


Fig. 2. Compressor, direct expansion coil, evaporative condenser.

culating pump and eliminators, as illustrated by Fig. 3. However, with this type of system it is difficult to control the humidity of the conditioned space during the summer.

Still another type of system may be used in churches that need air conditioning only for the 1½ to 2 hours that they are occupied each week. This system uses ice water as a refrigerating medium, and is dependent on ice for chilling the water. For this reason, the church in which this type of system is installed must be located where ice is easy to obtain. The equipment is bulky, requires a considerable amount of floor space, and is not easy to service. This system requires an ice storage tank (see Fig. 4) in addition to the equipment required for the well water system illustrated in Fig. 1. This tank holds cakes of ice, over which water is sprayed. The ice water is drawn off the bottom of the tank by a pump which circulates the water to the cooling coil in the air conditioning unit. Then the water is circulated back to the spray nozzles.

Other equipment may be combined to make up other types of air conditioning systems; however, the four systems previously described are most commonly used for this field of air conditioning.

As a practical example, let us consider the reasoning employed by the building committee of the recently completed Asbury Methodist Church in LaCrosse, Wisconsin. The author was a member of this committee.

The committee decided a two-pipe forced hot water system would provide comfortable inside temperatures regardless of that prevailing outdoors.

The temperature of the city water in LaCrosse is low enough in most parts of the city to obtain a fair degree of comfort cooling without the use of mechanical refrigeration. Therefore, we gave some thought to provisions for future and present air conditioning.

Like a great many church groups, our funds for building were limited. We knew that we could not afford to completely air condition the building with the money allotted for the mechanical work. With this in mind we made a study of the building's various spaces, their maximum possible usage, the times of day they would probably be occupied, and their exposures.

The eight Sunday school rooms have south and west exposures, and would be occupied only on Sunday morning from 9:30 a.m. to 10:30 a.m. Large windows gave these rooms excellent natural cross ventilation, and at the time of day that they would be occupied, the solar load would be practically negligible. Therefore, we decided not to consider, for the time being, summer air conditioning for these spaces.

The Wisconsin State Code required mechanical ventilation for the nave on the first floor and for the social room in the basement below the nave. We recommended that ventilating units and the duct work be selected and designed for future summer air conditioning. Thus when we wanted to install cooling equipment, we could do so with the least possible added expense.

The chapel was considered next. This room is used for worship services when the attendance does not warrant the use of the nave. Lenten services, youth worship services, and small weddings are usually held in the chapel. The chapel would be used mostly for Lenten services, which are held in the late winter and early spring, when cooling is not required. Therefore, we decided not to provide summer air conditioning for this space at first. Unit room conditioners could be installed later just as economically as at the time of the initial installation.

It was likely that the parlor would be used more frequently than any other space, with the exception of the

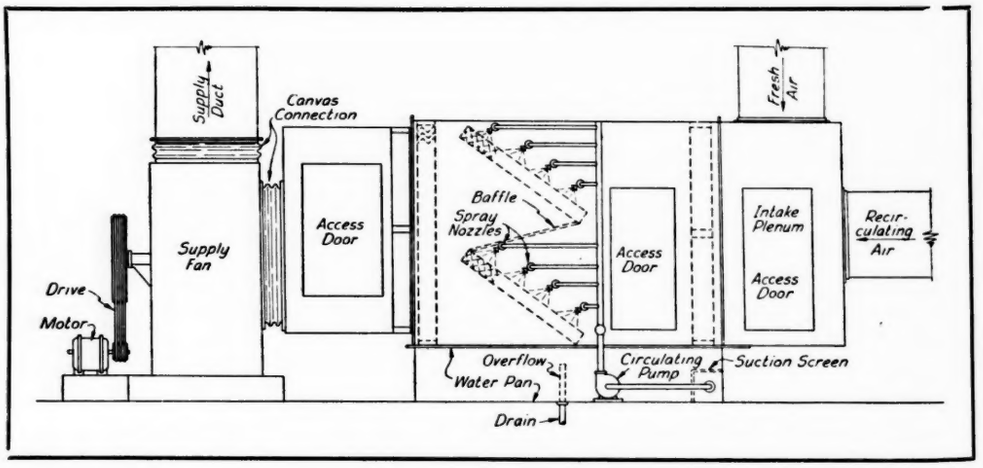


Fig. 3. Sprayed filter unit.

pastor's study. Small groups, such as the official board, committees, and women's society, would meet in this room. Under these conditions, it was felt that summer air conditioning in this space would be a practical expenditure.

Summer cooling for the pastor's study would also be justifiable. This room has a west exposure and a large window which would tend to make it quite warm during the afternoon. Moreover, the study would be occupied morning to evening, six days a week.

The church had a mechanical system installed that was designed around these recommendations of the building committee. The following paragraphs describe the system in more detail.

The heating system, two-pipe forced hot water, is divided into three zones, each provided with a separate circulator. One zone serves the convectors and the unit room conditioners in the service wing, which includes the Sunday school rooms, chapel, parlor and the pastor's study. A second zone serves the convectors in the nave, social room, kitchen, entrance halls and toilet rooms. The third zone serves the air conditioning units which supply tempered air during the winter to either the nave or to the parish hall.

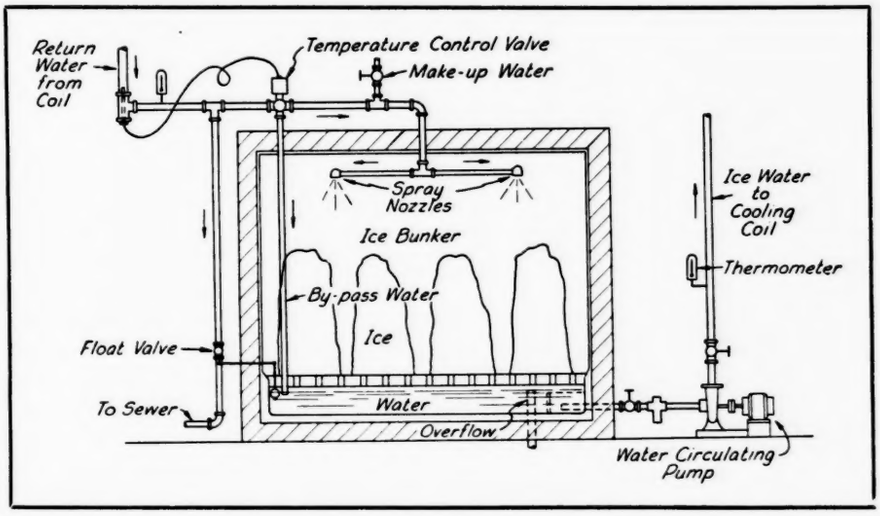


Fig. 4. Ice water system.

The boiler water is regulated by means of a compensated control with a temperature controller installed in a first floor corner room having a north and west exposure. The remote bulb is mounted outdoors. This controller registers the outdoor temperature, and varies the control point of the aquastat with its remote bulb installed in the boiler water. The aquastat controls the operation of the oil burner motor. Of course, it is wired through the conventional safety devices, such as a stack switch and a high limit aquastat. The boiler water temperature is automatically controlled from an upper limit 210F, at a minimum outdoor temperature of minus 24F, to low limit of approximately 100F, when the outdoor temperature reaches a maximum of 65F.

With this type of control, mild heat flows from the convectors during mild outdoor temperatures. The temperature of air from the convectors increases as the outdoor temperature becomes colder.

Fig. 5. Control panel in boiler room.

A convector was placed under each window to eliminate cold down drafts.

A state code made it mandatory to provide mechanical ventilation for the nave on the first floor and for the parish hall or social room, which is identical to the nave in floor area. The parish hall is located in the basement below the nave. The code states that there must be supplied 10 cfm of outdoor air per occupant. The amount of outdoor air was greater than the minimum amount of circulated air required, so the ventilation system was based on 100% outdoor air.

At no time would both the nave and the social room be in use at once. In order to reduce the cost of the installation as much as possible, factory-built air conditioning units were selected having a total capacity to meet the greatest requirements of the two spaces. These units were located at the rear and suspended from the ceiling of the stage which is directly below the first floor chancel. Two units, rather than one, were selected to conserve headroom below. They were installed back to back with a common fresh air intake between the units. See Fig. 6.

Inasmuch as these two units were to serve both the nave and the social room, a set of manually operated dampers was installed in the discharge duct of each. In this way, all of the air could be supplied to either of the two spaces, depending on which one was occupied and required ventilation.

Each of the units is equipped with two-row water coils with provisions for the addition of six rows for future summer air conditioning. The temperature is controlled with face and by-pass dampers, permitting continuous circulation of hot water through the coils, and preventing possible freezing of the coils when the outdoor temperature falls below freezing. As the conduction losses are taken care of by convectors, only tempered air is supplied by the air conditioning units.

Room unit air conditioners were installed in the

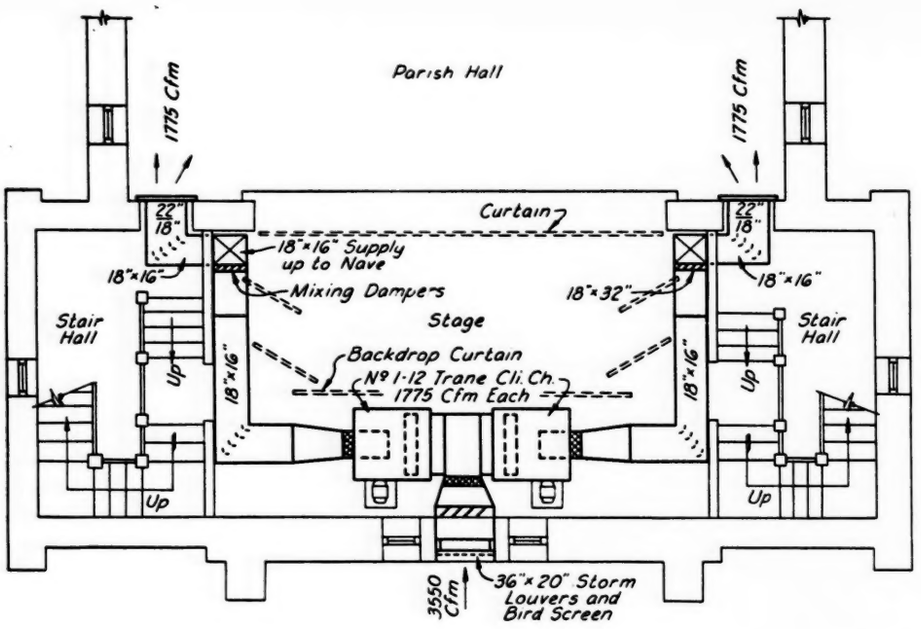


Fig. 6. Units on stage.

parlor and the pastor's study to provide heat during the winter and cooling during the summer. The coils in these units are cross valved with the heating mains and the city cold water main. Thus, hot water may be supplied during winter operation and city water during summer operation.

The city water used for cooling in the summer does not constitute an added expense, as this water, after it leaves the cooling coil, is piped to a hose bibb and reused for sprinkling the lawn. The waste water is also piped to a floor drain in the boiler room and, by changing two valves, it may be drained down the sewer when lawn sprinkling is not required.

The room temperature is controlled both winter and summer by means of a room thermostat. This thermostat is wired through a summer-winter switch, controlling the operation of a motorized valve located in the return water piping from the coil.

Individual room control during winter operation is obtained by manually operated dampers in the convectors. However, each zone circulator is controlled by means of a room thermostat located in a particular room having the most severe exposure.

Room thermostats, located in both the nave and the parish hall, control the operation of the circulator serving this zone. The thermostats are wired through a switch so that the control may be switched to either thermostat, depending upon which space is being used.

Summer air conditioning can be provided for the nave and the parish hall. This can be obtained merely by adding six-row water cooling coils to each of the present air conditioning units and cross connecting the heating mains to the city water main. A plugged tee has been provided in the sewer for handling the waste water at a point near the units.

The air supplied to the nave is relieved to the narthex by means of a grille at the floor. Fan type roof ventilators are provided for positively exhausting the air through grilles in the ceiling of the narthex (Fig. 7) and at the floor level of the balcony. These exhaust outlets are dampered so that the exhaust air may be properly controlled. Each grille is sized to handle 100% of the exhaust air.

The air supplied to the parish hall in the basement is exhausted through the serving hall and kitchen by a propeller type exhaust fan located near the ranges in the kitchen.

The system described above has been in operation two years and is producing excellent results with maximum economy.

There is a considerable amount of potential business in this field of air conditioning. Not only does this potentiality exist in new churches being planned, but also in the many existing churches throughout the country. With a little salesmanship, fortified by testimonials from church congregations already enjoying summer-winter air conditioning, much of this business can be realized.

Any church congregation planning to build a new edifice should certainly explore all the possibilities of comfort air conditioning before making a final choice upon the type of system to be employed. Bear in mind that careful and thoughtful planning in the initial installation will save money in the long run.

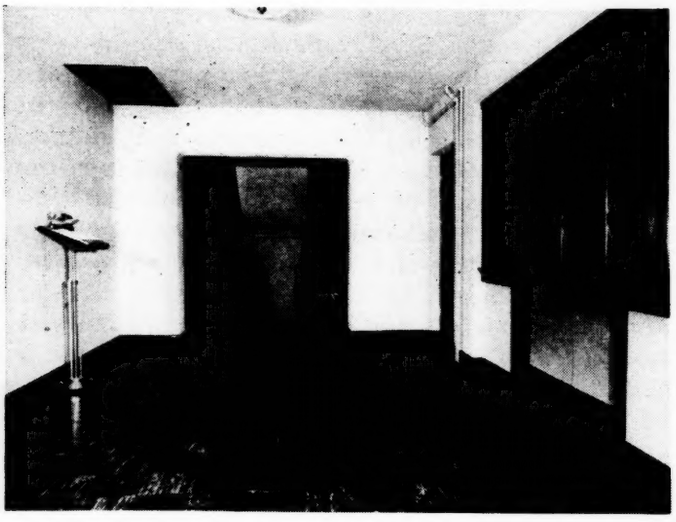


Fig. 7. Grilles in narthex.

A Graphical Method of Sizing Cyclone Dust Collectors

LEONARD MONROE
General Manager, Air Conditioning Co. of America,
Brooklyn, N. Y.

When properly designed, the cyclone dust collector is capable of removing a large proportion of the dust in industrial exhaust air with a minimum of expense. Although much research has been done to evaluate the influence of the many variables which are involved, proper design continues to present a difficult problem. This is due in part to a lack of agreement among the many investigators. Such considerations as effect of particle size, quantity of air, dimensions of the collector, and pressure losses are difficult to determine from published data. This article is a summary of the findings of a number of workers, and their recommendations. Much of their data has been incorporated into a nomograph for the simplification of design procedure.

THE basic shape of the cyclone dust collector in this country is the cylindrical shell with a conical collection chamber, as represented in Fig. 1, but the proportions vary with the investigator. The variables governing performance which most workers have considered are:

(1) Volume of air;
(2) Body dimensions including especially major cyclone cylinder diameter (dimension *D* in Fig. 1);
(3) Inlet area;
(4) Vane location and influence, if used;
(5) Efficiency of collection;
(6) Pressure loss through the collector.

Each of these will be considered, evaluated, and discussed so as to simplify the problem of selecting a suitable unit for any given set of conditions.

Design Criteria

The known quantities which constitute a preamble to design are: (1) volume of air to be handled; (2) characteristics of the dust, such as particle size distribution and specific gravity; (3) permissible concentration in the collector effluent.

The second and third of these variables have a direct bearing on the required effectiveness of the collector. Of the total weight of dust in the contaminated air, a certain percent will be arrested by the collector. This weight percent is called collector efficiency.

With a known volume of air and dust size analysis, the major cylinder diameter (dimension *D* in Fig. 1)

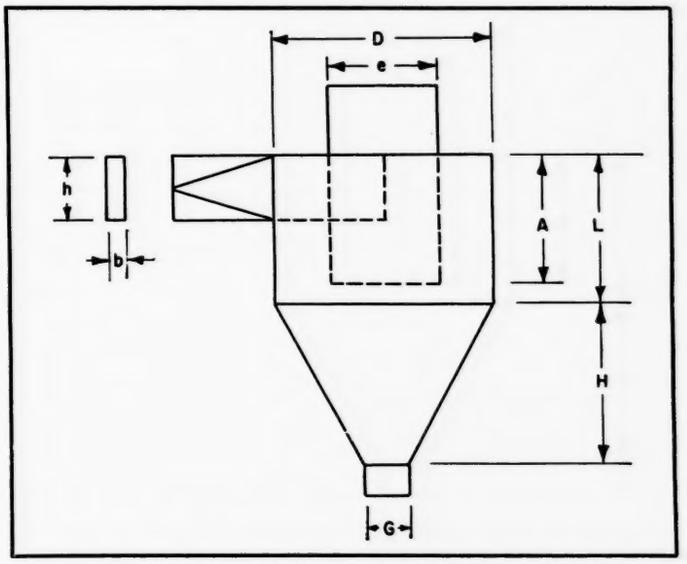


Fig. 1. Typical cyclone with dimensions used in text.

is determined by the required dust collecting efficiency. This efficiency in turn is limited by the weight proportion of minimum size particles in the generated dust, and can be considered to be a function of a centrifugal separation factor or coefficient *S*, described as

$$S = V^2/gr$$

where

V is the inlet velocity, fps
r is the major cylinder radius, feet
g is the acceleration of gravity, 32.2 ft per sec per sec
S is the separation factor, dimensionless

The weight in pounds of a dust particle times the separation factor is the centrifugal force in foot-pounds acting on the particle. Hence, the finer the dust or the higher the required efficiency of a cyclone collector, the higher must be the separation factor. The usual range of such coefficients is from 20 to 100.

Steps in the usual design procedure are: (1) determine the approximate dust size analysis; (2) select a suitable separation factor which will permit recovery of a large part of this dust; (3) determine a major cylinder radius from the above equation; and (4) select other body dimensions.

It must be remembered that as the major cylinder diameter increases, the inlet velocity to the collector must also increase in order to maintain the same separation factor. Since high inlet velocities require addi-

tional power for the system, by utilizing small diameter cyclones, it is possible to reduce the power requirements while handling the same amount of air. This is readily accomplished by the use of more than one cyclone, where they are arranged in parallel. In general, economic considerations will determine when it is advisable to substitute two or more small cyclones for a single large one. Larcombe[1] suggests 10 ft as a maximum for the major cylinder diameter.

Having selected a major cylinder diameter, it remains for the designer to choose the other body dimensions. Unfortunately, this will have to remain a matter of personal choice for the present, since published data do not indicate the most economical proportions. Most workers have indicated the measured pressure losses for their cyclones in terms of inlet velocity heads (IVH), and this information can be used as a guide when balanced against fabricating costs.

Pressure Loss

The problem of determining the pressure loss through a cyclone presents itself next, since it is on this basis that the designer will make his choice of a particular shape. It is regrettable that there is such sharp disagreement among the many authors concerning a rational method of predicting pressure drops through cyclone dust colectors. First's expression, based upon his investigations, relates most of the body dimensions of the simple cyclone. This expression for the pressure loss, F, is

$$F = \frac{12\ b\ h / c\ e^2}{(L\ H/D^2)^{1/3}}$$

Where, with reference to Fig. 1,

- b is the entry width in feet
- h is the entry height in feet
- L is the major cylinder height in feet
- H is the cone height in feet
- D is the major cylinder diameter in feet
- e is the exit duct diameter in feet
- c is a constant, dimensionless
- F is the collector pressure loss in inlet velocity heads

The value of c, which corrects for the influence of an inlet vane, is taken as 0.5 when no inlet vane is used, 1.0 for an inlet vane that does not touch the exit duct, and 2.0 for an inlet vane that extends to the exit duct, as shown in **Fig. 2.**

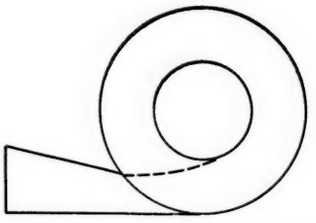


Fig. 2. Showing arrangement of inlet vane (dotted line) extending to exit duct (inner circle).

On the basis of his tests on a series of cyclones of varying dimensions, First has obtained an average error of 10% when computing losses with the above

[1]See bibliography for references to all sources mentioned.

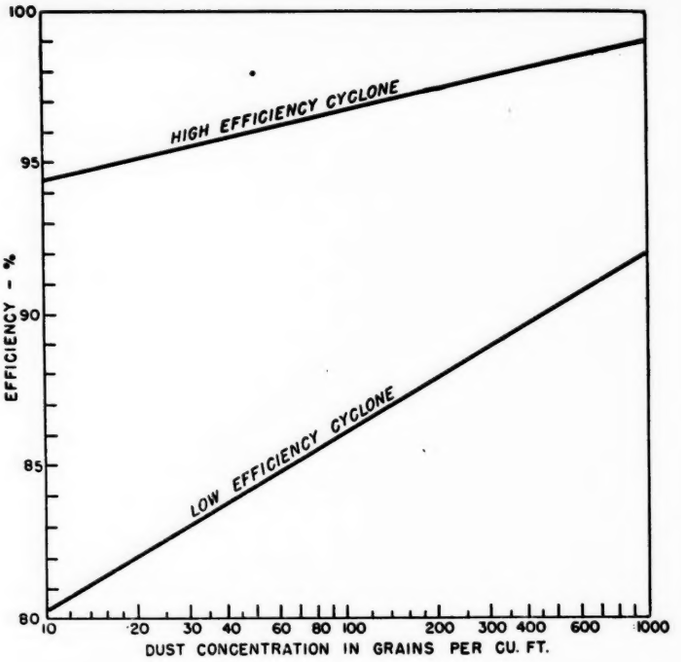


Fig. 3. Influence of dust concentration on efficiency.

equation. However, the same equation applied to other collectors gives discouraging results. For example, using the proportions recommended by the American Foundryman's Association, this equation yields a probable loss of 11.82 IVH, whereas the AFA reports a pressure loss of approximately 1.5 IVH. With Alden's plain cyclone, First's equation gives a pressure loss of 6.85 IVH. Alden reports a loss of 1.94 IVH. First's equation was derived with the purpose of improving an earlier expression proposed by Shephard and Lapple where the pressure loss was

$$F = \frac{C\ b\ h}{e^2}$$

where C is a dimensionless constant, and other symbols are as previously defined.

The constant C is taken as 7.5 when an inlet vane is used, 12 with a volute entrance, and 16 for a tangential entrance. Larcombe states that this equation gave satisfactory results when compared with his measured losses. Once again the formula appears to break down when used to compute losses for other cyclones. On First's collector, the equation predicts a loss of 1.21 IVH as opposed to a measured loss of 2.49 IVH. For the AFA collector there is an error of 480%. As Mr. Alden states in his book, "Having thus disposed of existing formulas, the author must confess that he has no alternative solution to offer." The only solution left to the designer is to choose the basic shape by considering reported losses and fabricating cost, and then use the published data as a guide for predicting the pressure loss. First established in his tests that when the dimensions of a cyclone are increased or decreased in a proportionate manner, the change in the pressure loss is negligible in terms of inlet velocity heads.

The use of a vane to guide the entering air stream will materially reduce the frictional loss in otherwise identical separators by directing the air flow so as to

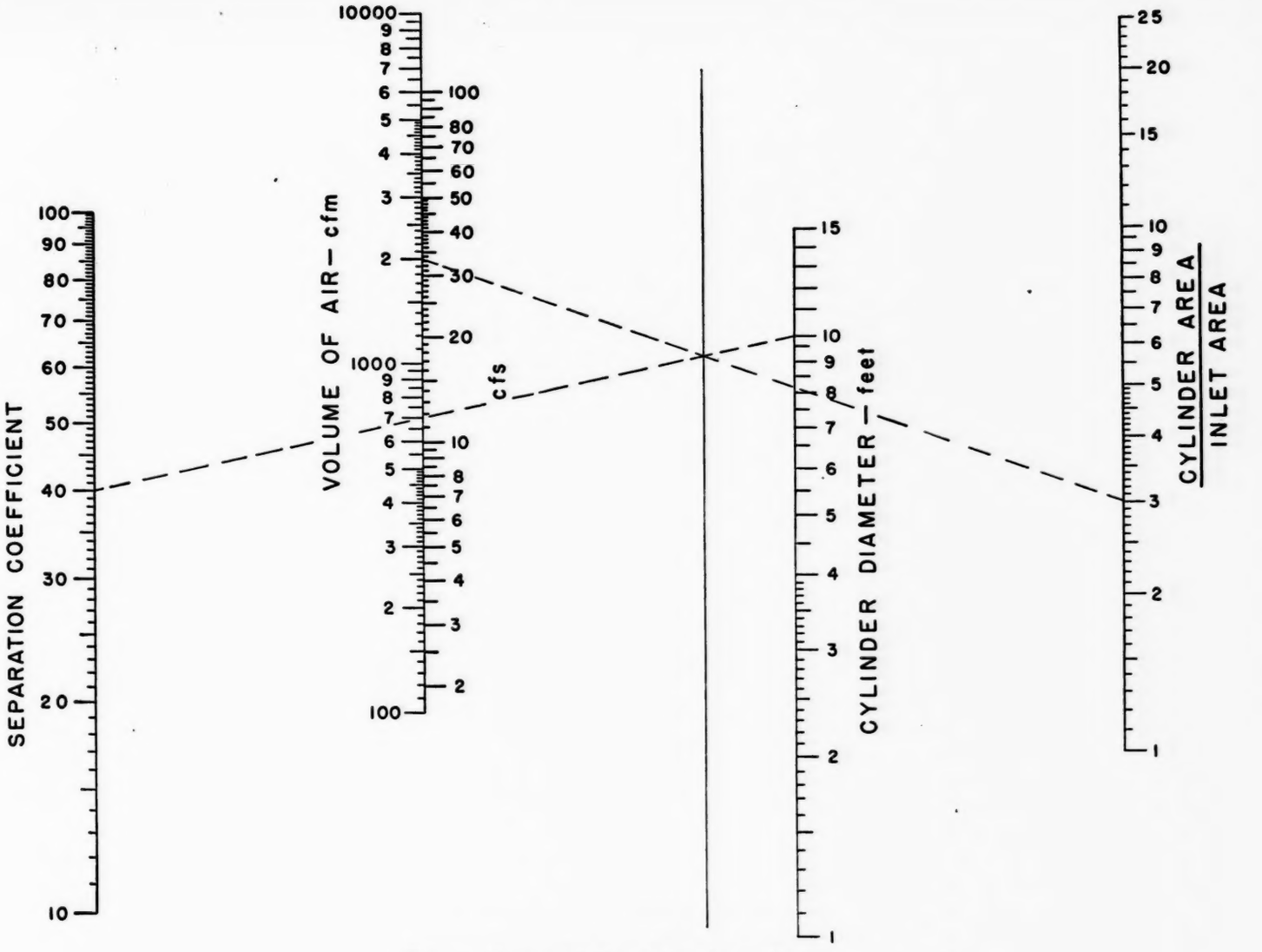


Fig. 4. Nomograph for sizing dust collectors.

minimize interference and lapping of successive air streams. Shephard and Lapple report an increase of 100% in the pressure loss when they removed the inlet vane from their cyclone. First found that the loss with an inlet vane was only 25% of that obtained otherwise for equal volumetric flow rates. It is evident that inclusion of an inlet vane will promote decided savings in power consumption and reduce the size of the propelling blower. For optimum results, the vane should extend from the outer cylinder wall to the exit duct, as shown in Fig. 2.

The dust collecting efficiency is decidedly influenced by the amount of dust in the air stream. Larcombe has provided a correction curve which will compensate for the concentration of dust in the air stream, Fig. 3.

Nomograph Developed

It is apparent that design of cyclone dust collectors is complicated by the many variables, and also by confusion among authors. To reduce the amount of calculations required, and to reduce the need for reference to other sources, an attempt has been made to collect the significant data and present them in their most usable fashion.

Table 1 lists recommended separation factors or coefficients for a variety of dusts, and these will serve as a guide in the selection of a separation factor. Sufficient information relating the variables of dusts is not available to permit an accurate choice of the separation factor. Some authors believe that the ter-

TABLE 1—TYPICAL SEPARATION FACTORS FOR SOME DUSTS

Dust	Dust Size Analysis, % of Total Weight	Centrifugal Factor	Collection Efficiency, %
Fly Ash	50% less than 50 microns	28	97
Stone dust	33% less than 20 microns	50	96
Emery dust	50% less than 50 microns	22	95
Rock dust	70% less than 35 microns	85	95
Cement kiln exhaust	73% less than 35 microns	100	89
Foundry sand	67% less than 45 microns	75	86
Limestone dust	66% less than 45 microns	93	91
Soap dust	87% less than 35 microns	85	99

minal settling velocity is the determining factor, but an equation relating terminal settling velocity to separation factor has not yet been proposed. Weighted choices based upon Table 1 should yield satisfactory results.

In order to reduce calculations, Fig. 4 was developed. This nomograph will permit the selection of a major cylinder diameter (dimension D in Fig. 1) quite readily. Before entering the chart, it is necessary to determine the quantity of air to be handled by the system, the approximate analysis by size of the dust in this air, and the ratio of the major cylinder area to the inlet area, $\pi D^2/4bh$. This ratio will vary with different collector shapes. Values of this ratio for certain collectors are included in Table 2. Other values, especially in lower ranges, may be used with judgment as to sizing other proportions of the collector. Having this information, it is possible to find the required major cylinder diameter without the need for computation by use of Fig. 4. This nomograph will yield good results for the ranges indicated. The cylinder diameter may vary up to 15 ft. If the chart indicates a larger cyclone than 10 ft, it is advisable to divide the volume of air into equal quantities, and find the proper diameter for the reduced volume. Having determined the cylinder diameter, the remaining dimensions of the collector can be read directly or estimated from Table 2. Included in this table are the measured pressure losses of the original investigator. With the reported losses as a guide, the determination of the power requirements of the entire dust collecting system can be easily evaluated. The problem of selecting a suitable inlet velocity need not be considered, since the inlet area and the quantity of air flowing automatically fix its value. In order to complete the design, it is necessary only to specify an appropriate transition from the main duct to the inlet of the collector. With volute entrances, only the final area immediately preceding the major cylinder diameter need be considered when selecting the ratio of areas.

TABLE 2—VARIOUS CYCLONE PROPORTIONS

Dimension[1] from Fig. 1	Source of Cyclone Description, See References							
	First	Shephard	AFA	Brandt	Larcombe[5]	Alden	Schneider	NYS[6]
D	1	1	1	1	1	1	1	1
e	0.5	0.467	0.5	0.318	0.4	0.452	0.5	0.477
L	0.7	2	0.75	0.43	0.5	0.762	0.55	0.595
H	0.75	2	1	0.935	0.9	0.905	0.875	0.833 + 15"
h	0.283	0.5	0.75	0.337	0.4	0.507	0.4	0.357
b	0.067	0.219	0.15	0.094	0.2	0.187	0.125	0.119
G	0.2	0.25	——	0.112	——	——	0.125	6" — 14"
A	0.6	1.5	0.75	0.43	0.4	0.715	0.125 + 2"	0.595
K[2]	41.5	7.15	6.98	25	9.83	8.28	15.7	18.4
Meas.[3] loss	[4]2.49	[4]3.94	1.5	——	——	1.97	——	——

[1]All dimensions based upon major cylinder diameter of 1.
[2]K is ratio of major cylinder area to inlet area.
[3]Measured losses given in number of inlet velocity heads.
[4]With inlet vane.
[5]With tangential outlet.
[6]New York State Department of Labor Standard.

Example

As an illustrative example, assume the following: S = 40, Volume of air = 2000 cfm, ratio of cylinder to inlet areas = 3.

With reference to Fig. 4, by setting a straightedge between 2000 cfm and ratio of areas of 3, we note where the straightedge crosses the turning scale. By connecting this point with the separation factor of 40, we read the required diameter of 10 feet, as shown by broken lines in Fig. 4. Should we decide to divide the air in order to reduce the size of the collector, we find that for a quantity of air of 1000 cfm, the required diameter is 7.6 feet. Thus we note that changing any of the original assumptions does not entail additional computation, but merely a shifting of the straightedge.

It is evident that further research into the general problem of cyclone dust collectors must be conducted before the design problem is reduced to a simple procedure of substituting values into an empirical expression. In the absence of such an expression, it is hoped that the nomograph will provide the simplest means of solving for the best collector to suit the conditions of any system.

References

(1) Larcombe, H. L. M., Centrifugal Dust Collectors, *Mining Magazine*, Sept., Oct., Nov., Dec., 1947.
(2) First, M. W., Cyclone Dust Collector Design, *ASME Paper No. 49-A-127*, Dec., 1949.
(3) *Fundamentals of Design, Construction, Operation and Maintenance of Exhaust Systems*, American Foundryman's Association, 1938.
(4) Alden, J. L., *Design of Industrial Exhaust Systems*, 2nd. Ed., 1948, The Industrial Press, New York.
(5) Shephard, C. B. and Lapple, C. E., Flow Patterns and Pressure Drop in Cyclone Dust Collectors, *Industrial and Engineering Chemistry*, Aug., 1939.
(6) Brandt, A. D., *Industrial Health Engineering*, 1947, John Wiley & Sons, Inc., New York.
(7) Schneider, F. B., Reduction of Pressure Drop Across Cyclone Dust Collectors, *G. E. Review*, Feb., 1950.
(8) *Standard Cyclone Proportions*, N. Y. State Dept. of Labor, Div. of Ind. Hygiene.

Warm Air Heating for Schools

F. W. OSBORN

Application Engineer, The Lennox Furnace Co., Marshalltown, Iowa

This is the sixth of a group of articles dealing with heating systems for school buildings. It presents design data for warm air heating systems for school buildings.

WARM air is an ideal heating medium for a great many educational buildings. The basic principles of heating these larger buildings are essentially the same as heating normal residences. Beyond the fundamental concept of residential heating with circulating warm air, there are a number of other things that must be taken into consideration in the heating and ventilating of these larger buildings.

A warm air heating system is so extremely flexible that there are many different design methods which can be used to achieve the end result of indoor comfort. Air temperatures can vary as can also the velocity in the ducts and at the outlet grilles. A number of different locations can be used for all elements of the warm air system. Although the methods outlined here will be found simple and practical and they will produce excellent indoor comfort results, there are other methods of design that will undoubtedly produce very satisfactory results.

Importance of Ventilation

Since in most schoolhouse heating applications the quantity of air for ventilation per occupant is specified by local codes, the designer should thoroughly familiarize himself with all aspects of these prevailing local codes.

In localities where there are no regulatory codes governing ventilation requirements for institutional buildings, or the existing codes are not specific in this respect, practical judgment in the application of ventilation should be followed. In schoolhouse work we have found it desirable in estimating the total air quantity to plan on handling about 30 cfm per occupant. Of this quantity, a minimum of about 10 cfm per occupant should be outdoor air.

It is good practice, as a rule, to provide a mechanical exhaust system for toilet and locker room spaces designed to handle about 2 cfm per sq ft of floor area in these rooms. This exhaust system usually accounts for about 50 to 70% of the outdoor air introduced. Generally it is not necessary to make special provisions for exhausting the remaining outdoor air. The excess air will escape from the building by normal leakage and will be beneficial to a certain extent in reducing the leakage of cold air into the building.

Ventilating Heat Load

The additional heat loss resulting from the introduction of the outdoor air may be calculated as follows:

$$\text{Btu per hr ventilating load} = \frac{\text{Cfm outdoor air} \times 60 \times (T_i - T_o)}{55}$$

where T_i = inside temperature and T_o = outside temperature.

The heating of this ventilation air is an expensive process, both in equipment and fuel. To avoid oversizing the heating equipment, the occupancy heat gain should be deducted from this ventilating load. We have found that a conservative average value to use for the heat gain resulting from school children and normal schoolroom activity, is 200 Btu per hr per person.

Selection of Total Air Quantity

In schoolhouse work, there is the problem of selecting the required air quantity. The quantity of air which is required for ventilation, based on 30 cfm per occupant, generally exceeds the quantity required for heating based on the simplified heat loss formula.

This being the case, we naturally select the quantity of air required for ventilation and use this as a basis for sizing the air handling equipment. Before doing this the designer should, of course, be certain that this ventilation air quantity actually does exceed the heating air quantity as determined by the heat loss formula. We do not know of a single instance where this has not been the case, but if there is any doubt it is easily checked and it is wise to do so.

Proportioning the Air

The total calculated air quantity should be proportioned among the various rooms on the basis of their respective heat loss. Using this method, the cfm to be supplied to any given room is established by the simple formula:

$$\text{Cfm for room} = \text{cfm total} \times \frac{\text{Btu heat loss of room}}{\text{Btu heat loss of building}}$$

Ductwork Design

Normally, the distribution systems for warm air schoolhouse heating are designed on the basis of equal friction. This is quite general practice except in a few cases where a number of individual units are used throughout the building with very short connected ductwork.

Velocity in trunk ducts of 800 to 1,200 fpm is satisfactory. These are quiet speeds and impose reasonable resistance so that blower operation is economical. Velocity in branch pipes of 600 to 800 fpm is satisfactory for the average installation. Higher velocities can be used where space is not readily available for the branch pipes. Higher branch velocities add to re-

sistance, and blower power and air noise is apt to result if these recommended velocities are exceeded by too wide a margin.

Turning Vanes

Velocity in the riser stack leading to the outlet or register should be about the same as the register velocity. If this riser velocity is much higher than the register velocity, the air will not turn quickly enough to provide good distribution over the entire face of the register. If the riser velocity must exceed the register velocity by more than 25%, as may be the case where space limitations make the use of smaller ducts absolutely necessary, then turning vanes should be used behind the register.

The use of square elbows with turning vanes in trunk ducts and branches is becoming more and more popular as space limitations in the buildings themselves become more stringent.

Selection of Registers and Return Grilles

By discharging warm air from the supply register at proper velocity it is possible to make the air carry across a rather large room. By locating the registers to spray properly warm air across the space, you can heat such rooms as large auditoriums, for example, with a minimum number of warm air registers. In other words, multiple registers with expensive and space-taking ductwork are not required where it is possible to place one or two which will direct the right air volume with proper velocity and direction.

Air Register Velocities

The location of the return air grilles also has a bearing on what kind of a supply register velocity will work satisfactorily. The following design principles for supply register velocity have proven satisfactory in our experience:

(1) Where return air grilles are on a side of the space opposite to the warm air supply registers, a register velocity of 125 to 150 fpm should be used for every 10 ft of distance across the room being heated. For example, if it is 50 ft from the front to the back of an auditorium, with warm air supply registers at the back and return grilles under the stage at the front, a warm air register velocity of 625 to 750 fpm will work very nicely.

(2) Where the return air grilles are on the same side of the room as the warm air supply registers, a register velocity of 150 to 200 fpm for every 10 ft of distance should be used. To use the previous example of the 50 ft auditorium, if both the warm air registers and the returns were at the front, a warm air register velocity of 750 to 1,000 fpm would be in order.

(3) Some designers prefer to use the discharging stream of warm air to wipe the side walls of the building, in which case somewhat higher register velocities are needed. For example, in auditoriums with high ceilings, very successful results have been obtained with warm air discharge velocities from 1,200 to 1,600 fpm using directional registers that direct the air against and along the outside walls. This picks up the air leakage around the windows and prevents it from reaching the floor where it may cause unpleasant drafts.

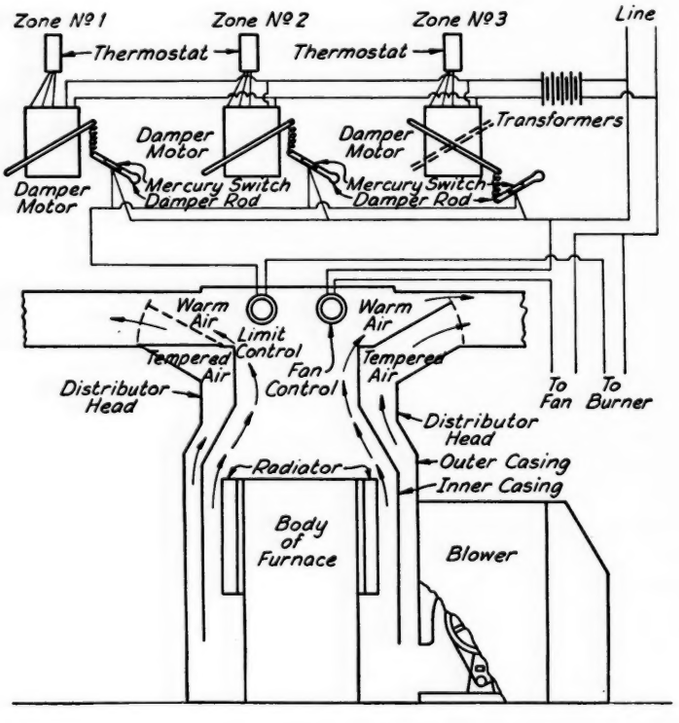


Fig. 1. By-pass arrangement for zone control.

Use of Directional Registers

In most of these larger systems, the warm air registers are well above head height and discharge horizontally or almost so. Therefore, in most cases, it is necessary to use the directional type of warm air register. Controlling the direction of discharge is very important. This is particularly true where ceilings are high, as may be the case in auditoriums or gymnasiums. If the warm air enters the room at the natural angle of about 45 deg or more above horizontal, too much of this air, and consequently too much heat, will be carried up to the ceiling. In effect, the warm air should be "sprayed" out over the space to be heated and should be so controlled that the velocity is down to 50 fpm or less before the air stream strikes any person.

In many of the older forced warm air systems in schools and churches, ordinary flat stamped grilles or wire grilles were used for warm air outlets. These devices did not allow proper control of the warm air stream and results were not very dependable. In all large warm air systems, particular attention should be given to controlling the direction of warm air discharge. This will solve many of the problems encountered in heating these spaces.

Return Grille Velocities

Because the return air grilles must always be in the floor or low in the side wall, the designer must avoid velocities at the returns high enough to create objectionable drafts for those nearby. For this reason, it

is usually necessary to use much lower face velocity at the returns than is needed at the warm air supplies.

Where return grilles are within 6 ft of where someone may be sitting, face velocities should be kept below 300 fpm. If returns are remote from where people are sitting, face velocities up to 500 fpm are not objectionable. Some designers make a practice of limiting return grille face velocities to 200 fpm in certain critical locations where occupants may be sitting very nearby.

Heating Equipment

For proper indoor comfort there must be constant but imperceptible air motion, for this constant air motion prevents stratification, cold floors and an uneven temperature distribution from room to room. In smaller buildings where zoning is not necessary, it is a simple matter to obtain this constant air motion. Where zoning is required, the problem is somewhat more complicated, but the designer can still do an excellent job of maintaining air motion if he arranges to zone the temperature of the delivered air rather than its quantity.

Where zone control is needed with a central heating plant, it is necessary to provide a mixing chamber above the furnace with two sections, one getting air from the furnace, Fig. 1, and the other section getting air that has by-passed the furnace.

The way to control this type of by-pass system is shown in the schematic wiring arrangement at the top of Fig. 1. Whenever any one of the zone thermostats calls for heat, the burner will be started, and it is then operated subject to the limit control. If only one zone of four, for example, calls for heat there will be so little air passing over the heat exchanger of the furnace and so much by-passing it that the temperature above the furnace will rise quickly and the burner will be shut down on limit control.

Use of Separate Furnaces

As in other types of buildings, if the heating requirements are widely different in different parts of the building, it is wise to install separate complete warm air systems wherever possible. A gymnasium, for example, has a very different heating requirement than the classroom in the same building. During the daytime, it might not require any heat because of non-use during school hours. At night when a crowd gathers, heat is needed to warm this room initially; as the occupancy increases, all heating must usually be turned off and additional ventilation may be required because of the heat gain from the occupants. If a completely separate system can be installed for this gymnasium, over-all results will be better.

Often the best answer to the problem of zone control may be found in the use of multiple furnaces. This is particularly adaptable where gas is the fuel. Vents for gas furnaces can be concealed in the building construction quite economically, and for this reason gas furnaces can be located at widely separate points in the building. The size and length of ductwork is reduced so much by these separate installations that it sometimes costs less to install more than one complete furnace system than it would to install a single large unit with zone controls. By this method, zone control is achieved by controlling the separate furnace for each logical zone. We should also point out a possible disadvantage to be considered in connection with the use of separate furnaces for each zone. Electrostatic air cleaning equipment is finding a more universal application every day with these heating and ventilating systems, and it is more practical and less expensive to install this equipment in one large central unit rather than in several small units.

Controls

The progress made in recent years with the heat-accelerated type of thermostat has made it possible to obtain the best room temperature control with simple electrical control devices long familiar to the heating industry. It is entirely reasonable to expect that these new models of the familiar controls will maintain temperature in the space within a fraction of a degree when heating is required. Furthermore, they can be adapted either to a zoned central system or to individual furnaces. In the case of individual furnaces they are already furnished as standard equipment by most of the leading manufacturers.

We should mention here that pneumatic controls, where they are requested or where the building is already equipped with them, can also be used very satisfactorily with warm air heating equipment on zone control applications.

In the case of the zoned central furnace system, everything is essentially the same as shown in Fig. 1 except that pneumatic zone pressure switches replace the mercury switches actuated by damper motors.

Where individual furnaces are used for each zone, the outdoor air supply for the respective zone may also be controlled by the pneumatic thermostat, if it is desired to do so. The working of this system is very much like the operation of the typical unit ventilator cycle and employs the same pneumatic thermostat with a 3F throttling range.

The only control change necessary to adapt such a system to operate with a warm air furnace is to substitute an air pressure switch and a cycle timer for the automatic valve normally used with a unit ventilator. The pressure switch is set with a narrow differential to operate the furnace over a spread of the middle ½ degree of the 3F thermostat differential; therefore, the cycle timer is required to prevent burner operations shorter than 3 minutes.

In all school heating systems, a convenient means should be provided to close off the outside ventilation air at night and over week-ends when the building must be heated but does not require outdoor air for ventilation. There is no need to waste heat until the ventilation is required for the occupants.

In some cases it is also desirable to install a damper in the blower discharge to reduce cfm and motor power consumption to a point that will just handle the heating load when the school is not in session. When resistance is increased on the usual fan used in these applications, the cfm handled will be reduced and the motor load decreases. An arrangement such as this effects a saving sufficient to justify its installation on larger jobs where a single furnace is employed.

Errors Often Made in Forced Hot Water Heating Systems

T. W. REYNOLDS

Last month, Mr. Reynolds examined basic reasoning behind the safety loop, circulator location, and air venting. In this concluding installment of a two-part article, special fittings for boilers and mains, flow control, expansion tanks, and system balance are discussed.

Part 2

The Boiler Fitting

It is easier to remove air from water at a point of low velocity, such as exists within the boiler, than it is out in the higher velocity water of the mains. The boiler fitting (Fig. 8) does this most effectively. It is installed directly into the top of the boiler (Fig. 9) by means of a shoulder nipple of the same size as the flow control valve, or the size of the supply main where there is no control valve.

A tube of smaller size (enclosed within the shoulder nipple as an extension of the supply main) is projected down below the shoulder nipple into that part of the boiler water which is most active or circulating, as required for the particular boiler in which it is installed. Air collects at the highest point within the boiler above the tube entrance and flows in the pipe around the tube and up to the tee fitting and then the expansion tank. A boiler with only a side outlet must be connected as shown (Fig. 10) and provided with a dirt pocket. Incidentally, the tube is made adjustable so that it can be slid up in the nipple above the fitting should the tube strike any internal parts of the boiler.

Recently, I found a job without the special boiler and tank fittings and with too small a tank, just a combination of the usual wrong things. The result was air in the system with but little in the tank; hence, the tank was continually water-logging and so the relief valve was frequently relieving at the usual setting of 30 lb per sq inch. Prior to this relief, a former relief valve did not relieve even at 45 lb per sq inch, which pressure was quickly reached. As a consequence of this pressure or its multiplication by water hammer, certain convectors leaked at seams of headers. Copper convectors are not recommended for use above 40 lb per sq inch pressure, although tested to 100 lb, while boilers and cast iron radiators are guaranteed for only 30 lb in hot water heating systems.

To this same job a tank fitting was eventually added, but with no boiler fitting. The air by-passed

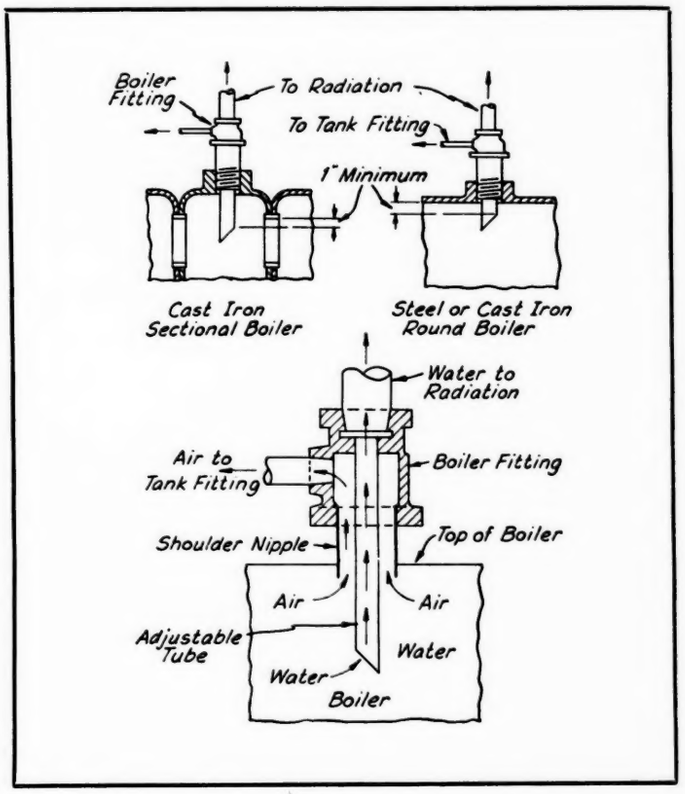


Fig. 8. Boiler fitting to direct air to tank.

the tank on the way out to the distribution system. This factor, plus the under-size of the tank, caused the relief valve to continue its intermittent flow. The owner then drew down the water to empty the radiators in the attic, thus making, in effect, an expansion tank or space out of the highest radiators. Troubles, however, still remained, because these small tubular radiators contained no more air than could the air space of the expansion tank had this space not been water-logged. Incidentally, the tube of the tank fitting projected into the tank too far, thus leaving but little air expansion space.

The Expansion Tank

Water temperatures being commonly higher than in the old gravity system, pressures must be higher to prevent boiling of the water; hence, the use of a closed tank becomes imperative. The expansion or compression tank also provides a collection chamber for air as it is released from the system, thereby providing its second purpose in the way of an air cushion by compression as a protection against high or sudden pressures and any shocks from water hammer which

might injure the boiler. Since a tank of adequate size prevents frequent operation of the relief valve, it saves water and the heat it contains and lessens the tendency to boiler scale. The continual adding of water to a boiler brings in sediment, lime and other foreign matter which have a bad effect in time on the boiler. A down feed system with reverse circulation requires two tanks, one for air released at boiler top and the other for air released from hot water at the high point of the supply riser (Fig. 11).

The closed expansion tank is too often sized by catalog and rule of thumb without considering the variables from job to job. A tank in the top story varies its air volume only as the water expands or contracts, but one in a basement has its air further compressed by the static pressure due to height of water column. Some size the tank on the basis of 10% of the total water content in the heating system, which normally should be ample, but if this percentage is considered correct for a one-story building, the tank will be oversized when located at the highest point of two or more story buildings. For the foregoing basis of 10%, a basement tank should be 13%, 17%, and 23% for two-, three-, and four-story buildings, respectively.

A boiler started up from cold may have an expansion of 4% to 5% and if the tank is maintained, as usual, half full of water, the basis of tank sizing in one-story buildings should be 10%. In actuality, we have only the mean water operating temperature to deal with, since wastage of water due to greater expansion from cold upon initial filling is of no moment. So we would then have an expansion of 2%, or a tank capacity of 4%.

Few realize, when roughly estimating water content, that most of the water is in the boiler, especially so with an oversized boiler. Even the expansion tank

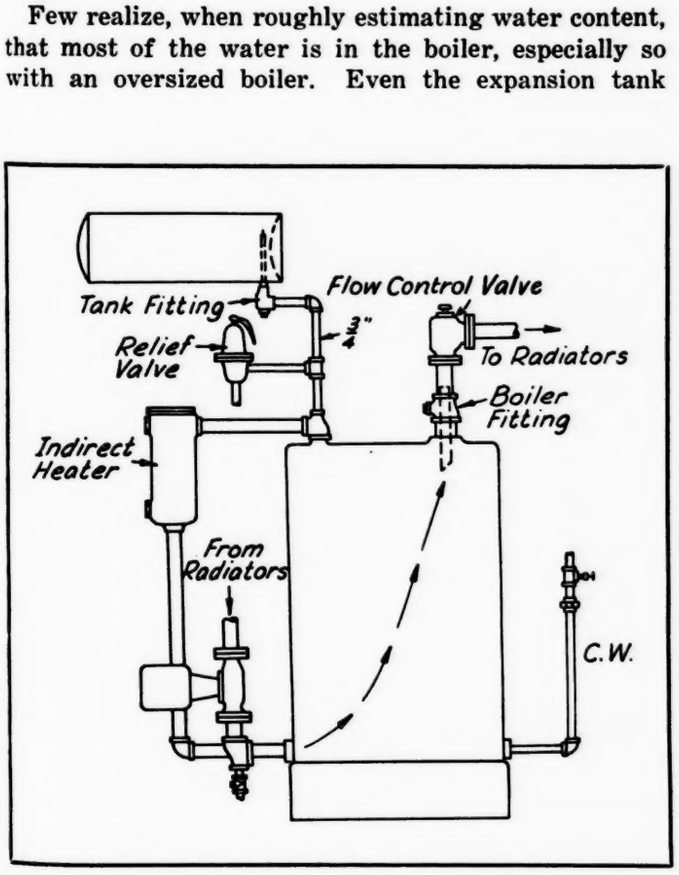


Fig. 9. Alternate arrangement for confining air to tank.

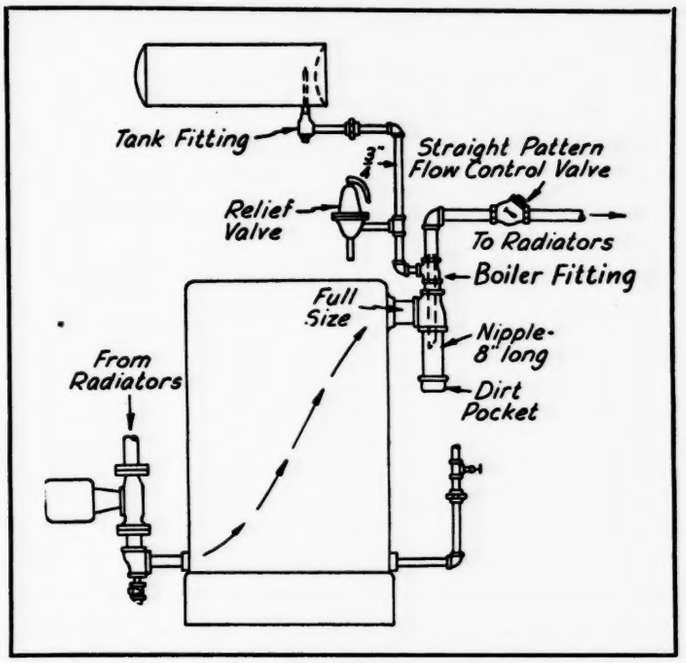


Fig. 10. Arrangement for confining air to tank with side outlet boiler.

may contain as much water as in all convectors combined. Modern cast iron close centered tubular radiation will only average one-tenth of a gallon of water content per square foot of radiation, while copper convectors in residential work have but 10% of this gallonage. Since radiators in residences usually average 30 sq ft of surface, one can allow for each radiator, three gallons each for those of cast iron tubular section with close centers, and one-third of a gallon for each copper convector. More precise water content of the particular boiler and radiators selected can, of course, be obtained from the manufacturers. The water content of the pipes and expansion tank can be readily computed.

Convectors of cast iron in fractional widths slightly less than 4, 6, 8 and 9 inches have a water content in pounds per inch of length of 0.18, 0.25, 0.32 and 0.42, respectively. Pounds of water content of Arco (close center) cast iron tubular radiation is in accordance with the following table.

No. of Tubes	Height of Radiator, Inches	Pounds of Water Per Section
3	25	1.02
4	19	1.03
4	22	1.22
4	25	1.52
5	22	1.60
5	25	1.76
6	19	1.57
6	25	2.05
6	32	2.65

The Flow Control Valve

The flow control valve is a hinged valve which is forced open when the circulator starts and closes of its own weight when the circulator stops. When closed, the boiler water can continue to be heated and maintained to the temperature required for heating domestic hot water supply all year around or for quick heating of the building as heat is required. The

control valve should be of a type which can be set fully open or closed by manual adjustment. It should not be installed in a vertical pipe unless as an angle valve at the top of the vertical rise (Fig. 9).

Considering dynamic conditions, there is no difference whether the valve is of the angle type with vertical dead lift of check flap (as with the opening of a trap door over one's head), or of the horizontal swing type (as with the swing of a door). A straight run of horizontal pipe usually offers the most convenient location, and so the valve is usually of the straight flow type (Fig. 10).

Where to Put Control Valves

Small pipe installations of one zone use only one control valve, but one on the supply main and again on the return main are required for each zone of a zoned job. Old gravity systems converted to forced circulation, where old pipe sizes are large enough to encourage reverse circulation, also require two control valves. A down fed system of considerable height, such as shown in Fig. 11, will likewise require two such valves, because the height gives quite a thermal head likely to continue circulation by leakage through a circulator. One of these control valves must be installed overhead remote from the boiler, as shown, to allow venting of the riser to continue whenever the upper control valve closes. No control valve is required in low level radiation because circulation cannot continue when the circulator stops.

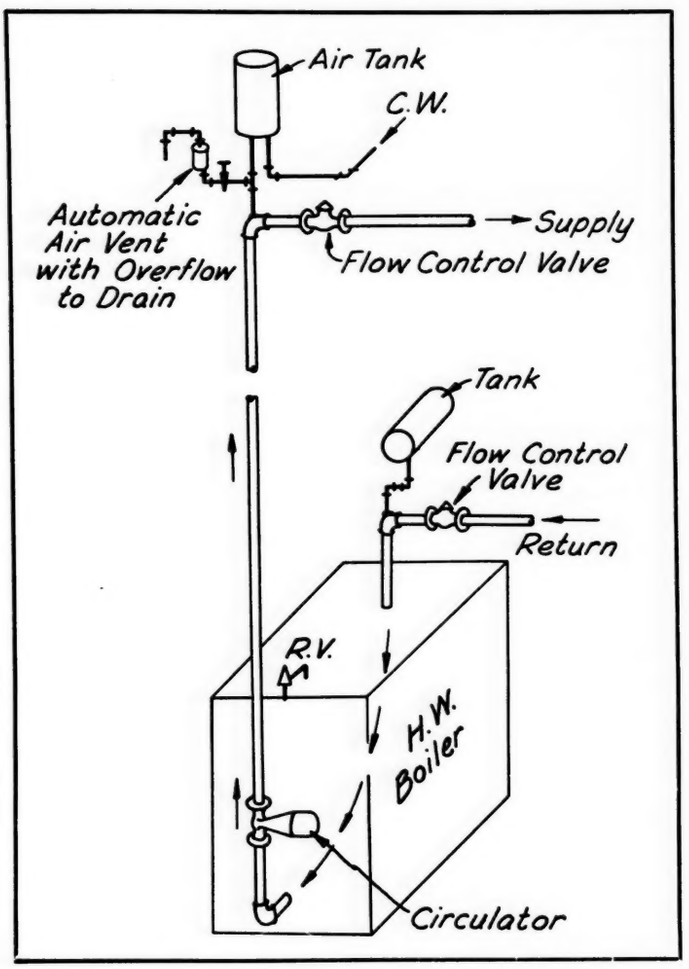


Fig. 11. Arrangement of a downfeed system.

Special Fittings for the Mains

The precise use of the special fittings shown in Fig. 12 on a one-pipe main is not always understood. Recently, I saw an installation of basement radiators where the distance between the special downfeed supply and return fittings was carefully kept to the full length of the radiator below, as usually recommended, but the purpose of this recommendation was defeated by the unnecessary amount of pipe and fittings used. Since the circulation downward to basement radiators is contrary to natural flow, the arrangement should have been as shown in Fig. 13 where the flow is short and direct to give minimum resistance to flow.

The recommendation referred to had been further misunderstood by applying it when using the upfeed fittings to higher radiators. These special fittings had first been installed on the main with close nipples between them, but the owner separated them by the length of the radiator above. This was unnecessary, since it is doubtful whether there is any measurable degree of stratification in the small size of mains now customarily used.

Stratification is also less likely due to the greater quantity of water circulated in the mains, for while the water leaving radiators may have a 20-degree temperature drop at peak loads, the drop in the main is but slight. The temperature drop effect is practically the same as if the boiler were placed under each radiator or riser branch, whether or not there are as many as 30 or 40 radiators on a circuit. Even though the supply fitting takes water from the top of the main while the return fitting delivers this water as cooled to the bottom of the main, nevertheless the special fittings interpose themselves within the main to mix its flow. In the final analysis, stratification is more theoretical than actual.

The supply fitting streamlines the flow to the radiators in the proportions desired while passing the main body of water through the eccentric central tube of the fitting. The return fitting has a restriction or contraction whose venturi-like effect induces a flow from the radiators. Neither fitting penalizes the pump with excessive resistance.

Where only one special upfeed fitting is used on the main for each combination of supply and return branch, it may be installed either on the supply or return, although with greater effectiveness on the return, due to the inductive effect of this fitting. Both fittings should be used, however, where the structural characteristics of the installation are such that there might be a question as to good circulation. The combination of two fittings provide increased diversion capacity for any installation and smaller sized risers for large installations. In small installations, any saving in pipe sizes, if any at all, may be of no moment, because there are minimum pipe sizes in any event. In the case of radiators below the main, two fittings must be used.

The supply fitting has the eccentric sleeve for flow in a reverse position from that of the return fitting, so care must be taken to use the right fitting in the right place. As may be seen in Fig. 12, the upfeed

return fitting may be used for a downfeed supply fitting and the upfeed supply fitting may be used for a downfeed return fitting. In such cases, the fittings must be reversed from their normal position through an 180° angle horizontally and vertically.

To insure proper installation in the field, all special fittings have plates screwed on, colored red or black, and marked "Up Feed" or "Down Feed" according to use desired. On these plates there is also a horizontal arrow indicating direction of flow in the main and a vertical arrow indicating direction of flow to or from the main. The eccentric sleeve of a downfeed supply fitting is vented. This may be desirable in some installations, and, for convenience in manufacture, the vent hole has recently been produced in all other of these special fittings. Fittings may be of cast iron or streamline copper as desired.

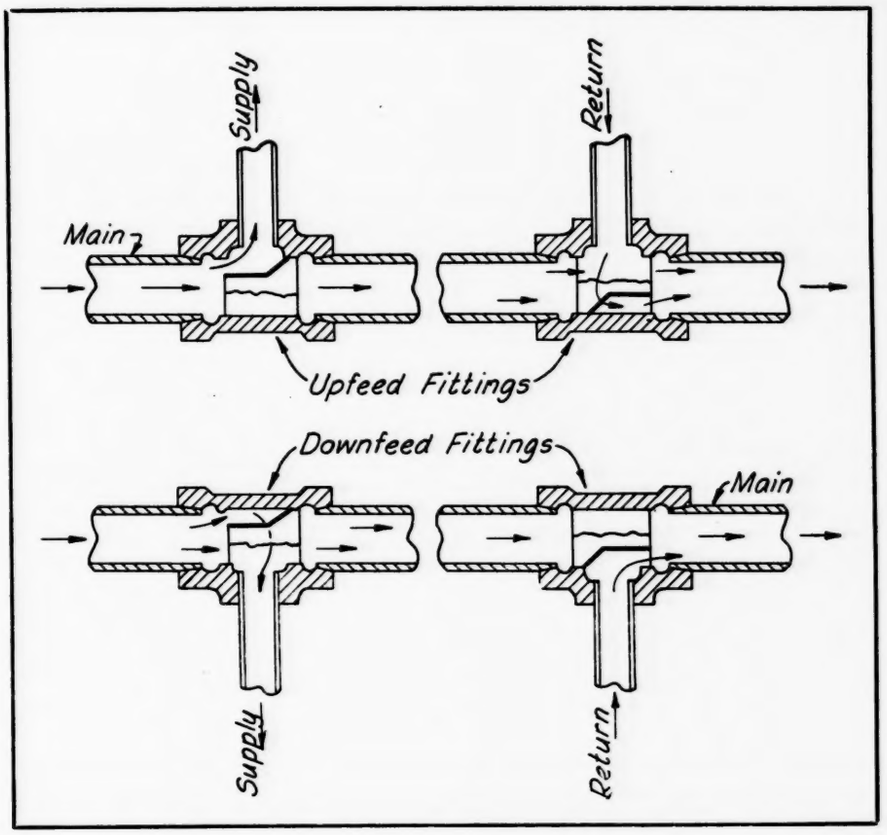


Fig. 12. Special fittings on mains to proportion flow.

The Distribution System

Mains of a one-pipe system may be run level, thus saving the contractor's time of otherwise figuring the pitch for each branch. If not run level, the mains should be continuously graded, and also vented, unless there are branches to higher levels at frequent points. If run level, the level should be accurately checked.

Dividing the supply main into two circuits should be done as shown in Fig. 14, with a wye connection and an eccentric reducer to eliminate air pockets. Low level systems must be drained at their lowest points as shown (Fig. 1 and 13C).

Branches to radiators, especially those to top floor radiators, should be connected as shown in Fig. 15. With the supply connection to the top of the radiator any air collecting at these high points will keep the water in the supply pipe below its entrance to the radiator, thus stopping all radiator circulation.

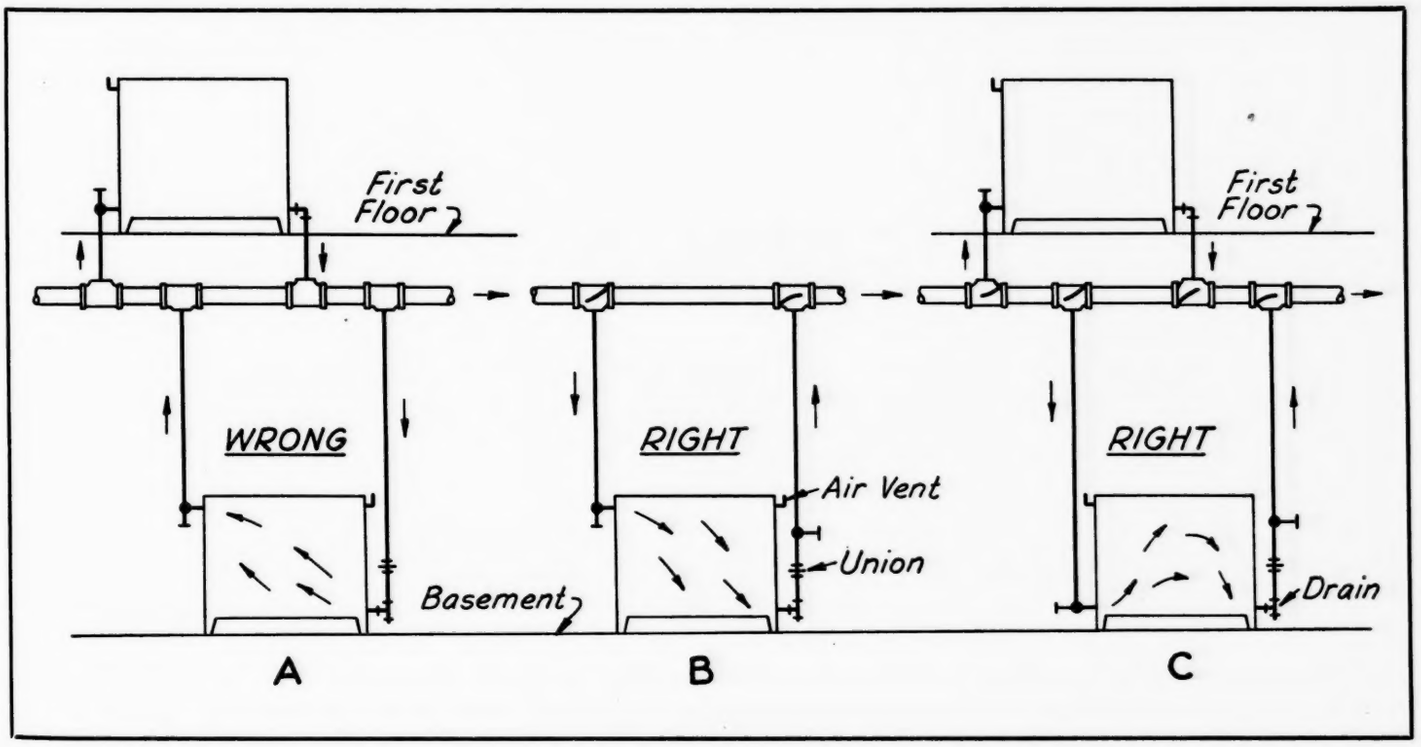


Fig. 13. Connecting radiators below the mains.

Branches to radiators, where all radiation is below the main, should be made as shown at *B* in Fig. 13. With some below, and some immediately above, or relatively close by, the branches should be arranged as shown at *C* in Fig. 13. The reason for such connections has often been misinterpreted. Seldom is it understood that these bottom radiator connections are made solely for the purpose of keeping water in the lower radiator static or motionless whenever the pump stops running. If these connections are made top and bottom, as shown at *A* in Fig. 13, then, whenever the positive action of the pump has ceased, the hot water left in the radiator may rise by nature and reverse its flow through the supply branch to the main and nearby high radiator. This action will cease only when the upper radiator has dissipated its own heat and that of the water from the low radiator. Meanwhile, the upper radiator will overheat the space it is in. Trapping of the hot water by all bottom connections (*C* of Fig. 13) will eliminate this trouble.

Radiators below the main have both to receive and discharge their water contrary to natural circulation gravity, hot water down and cold water up. However, the pump when in action puts water both above and below the main in accordance with the pressure drop through the radiators. Radiator valves can be throttled to give the pressure drop desired for balancing; nevertheless, connections to radiators below the main should be preferably favored by short and direct piping using fewest fittings. Taking the connections off of the main at points apart equal to radiator length accomplishes this (Fig. 13). Of course, both upper and lower radiators, dependent upon conditions, may require some additional turns for swing or spring of branches, but this should not be made greater than the need in the case of low radiators.

Air will have to be manually vented from the radiator because of the trap within the radiator above its bottom pipe connections (*C* of Fig. 13). Even with *B* of Fig. 13 with top and bottom connections, an air vent is desirable for use upon initial filling of the system. This initial filling may be slowly done, yet as soon as the water in the radiator has risen above the top of the return outlet, air will be trapped in the remaining height of the radiator. In time, this air may work back through the water to the main, nevertheless the expenditure for an air vent is but little. The return branches of these down fed radiators should be fitted each with a union and a drain plug (Fig. 13).

It is a good practice to install an air vent on any radiator, no matter where located; in fact, in hot water heating, it is a wise precaution to install an air vent at any point in the system where there is the slightest doubt as to its need. A vent pipe to expansion tank is needed between the flow control valve and the circulator on reverse circulation (Fig. 2). An automatic vent valve is required at the top of an upfeed supply riser (Fig. 11). The pipe to this valve should be run up as shown and not dropped down to form an air pocket before connecting to the vent valve, as would be the case with a lower position of this valve.

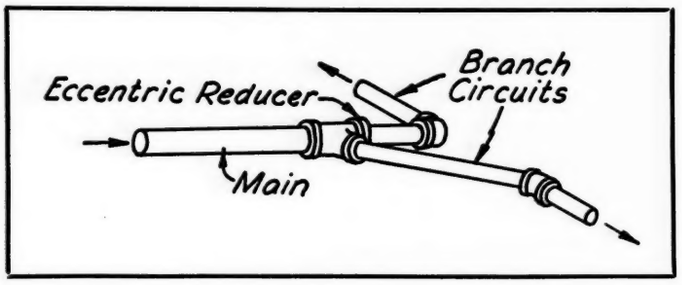


Fig. 14. Avoiding air pockets in distribution piping.

Balancing the System

Cast iron radiation retains heat longer than convectors (particularly convectors of copper) after the burner shuts off. Furthermore, cast iron radiators have less resistance to flow of water. Because of these things, wherever both convectors and cast iron radiators are used in the same installation, the system should be designed so that each type of radiation is on a separate circuit. The piping can then be sized in accordance with the differing requirements of the circuits. However, zoning with a a separate circulator is the only sure method. Continuous operation rather than intermittent operation is also of help in such situations. In this event, the medium is tempered through a mixing valve, but more often than not such an arrangement becomes unsatisfactory.

Top Floor Too Hot

Recently, I inspected an upfeed forced hot water heating system in a three-story residence having cast iron tubular radiation with sections on close centers on the top floor. All other floors had copper convectors. The increased flow of water due to height of topmost radiators, the heavier metal of these radiators, their higher rate of heat emission at lower temperatures, and their oversize, due to roof being well insulated after radiator sizes had been calculated for no insulation, all combined to make the top floor far too hot and this made the second floor too cold. The situation was further aggravated by heat rising in a stair well open all the way up to the top. Any of these factors in themselves alone should have been sufficient to unbalance heating. It was found of some help to valve off one of the two radiators in each top floor room. Throttling the supply valve of all top floor radiators gave even better conditions. A zoned circuit to this upper floor would have been best, especially so as this floor has a further individuality due to ceiling heat loss.

Radiators should be properly proportioned in any heating system to insure comfort. Rooms intermittently used should preferably be zoned. Best control of any system is obtained with the system down fed, especially so in a building of four or more stories, although up fed jobs three stories or less are usually satisfactory. Stairways which create flues send a lot of hot air up above head level and bring down a lot of cold air make-up at lower levels close to the

steps. To heat this cold air, and heat it well, considering its draft effect, one should oversize the entry radiators. These are some of the things to keep in mind.

Oversize boilers contains too much water and require larger expansion tanks because of the increased volume of water. Larger boiler volume gives some gain in heat absorption due to lower water temperature. Such advantage is probably offset by slower water flow over heat-absorbing surfaces. In any event, there is a decided loss if there is only one supply and one return connection at the boiler and these so located with respect to one another that water short-circuits through the boiler directly from one to the other.

Bath Room Radiation

There are so many troubles in hot water heating which have been eliminated by some thinking mingled with cut and try. Some remedies have even been discovered by accident without knowing the whyfore until long after, the reason for the correction at first being erroneously given. Take the radiators in a bath room, for example. Why are such rooms so often cold, even when the radiation is computed on the basis of maintaining such spaces at 80F? Furthermore, exposed bath room radiators of cast iron have few sections, and the end sections having more surface, give off more heat than the others do.

The best opinion as to any difficulty with bath rooms seems to be that oversize circulators pass the water in the main or riser so fast past small size radiator connections that the water does not enter the connections. In such cases, any pumping of excess water can be eliminated by throttling down with the valve at the circulator, or by a valve on the branch where this trouble is likely. Larger radiator connections should also be of help. Generally speaking, the trouble as cited more often occurs on the larger jobs.

Valving the System

Radiator valves and balancing ells add to the cost of a system, but if the system is in our own home, we are quite apt to put them in. A balancing union elbow is not so much needed when the system or zone is small and special diverting fittings are used on the mains. This fitting is much less needed when the return is reversed. Nevertheless, these special elbows are nice to have on a system and give relief, especially by balancing down a radiator which happens to be oversize or over circulated with hottest water. The balancing ell cannot be used for tight closure, therefore cannot be used as a stop valve, nor can any hot water flow valve arranged for pinhole circulation.

Radiator valves allow removal of a radiator without draw down of water. They can hardly be justified for this reason alone, although removal of any basement radiator would necessitate complete draw down and later refill. Suppose, however, a radiator leaks (and I know some cases), it is then a great convenience to have shut-off valves at the radiator to limit water damage.

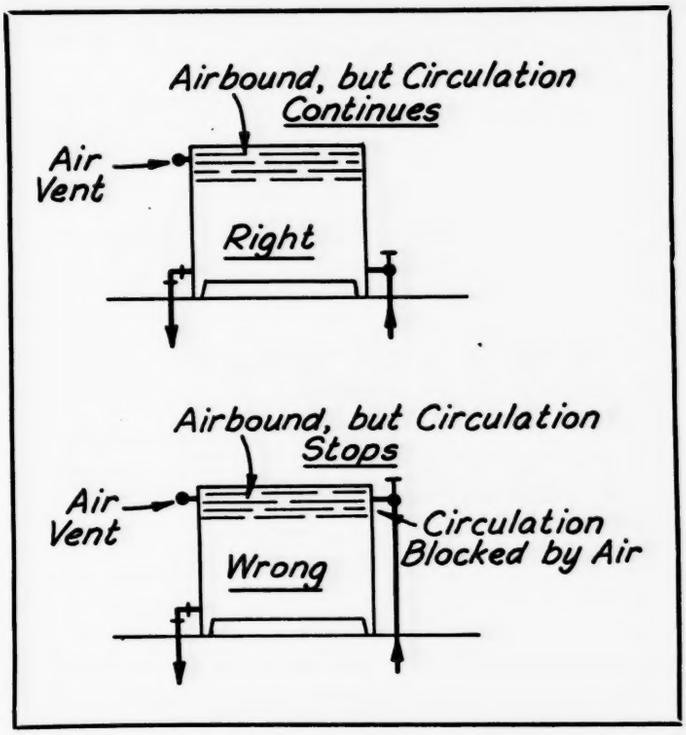


Fig. 15. Connecting radiators above the mains.

Speaking of water damage, consider how possible this is where the owner wants everything automatic. He will then arrange the pressure reducing valve for automatic make-up of water. As a radiator leaks or breaks, water pressure drops, then this valve makes good with a vengeance. An actual case comes to mind. An owner, going to Florida, asked the next door neighbor to occasionally check and keep an eye on the owner's heating system. Subsequently, the neighbor had an accident, broke a leg and lost an eye, so he couldn't very well watch the system. A second floor radiator promptly broke some other part of its body, and the water, thereby released, broke the record on water damage. On the first floor, the ceiling was a total loss and the furniture as well. In the basement, water filled up to joists above as floor drains clogged up. Water finally came out at the front door and was noticed by someone passing. In view of this relation, it would seem that manual fill of a hot water system is safest. Any fill or make-up is small in amount and seldom required.

Filling and Cleaning the System

It is generally thought that a hot water heating system does not need cleaning out; however, on new construction there is a lot of core sand and grease which returns to the boiler and plays hob with the circulator. Draw down some of this water and it comes out like molasses. Such a mixture cannot heat the building efficiently, nor the domestic water supply passing through the heat exchanger.

Few know how (or won't take the time) to properly fill and vent a hot water heating system, especially when it is of the floor panel or baseboard type. Fill must be slow, almost a bleeding process. Many will have water in the second floor radiators before they have fully vented radiators below.

Ventilating the 200-Seat Theater

JOHN J. SEFING
Consulting Theater Engineer, Toledo, Ohio

In a very practical manner, an engineer with considerable theater experience discusses the design and installation of ventilating systems for theaters with from 200 to 400 seats. In addition, the author presents a number of pertinent suggestions on the care, servicing and installation of a fan or blower in the average simple ventilating system. This information applies to theaters of this group as well as to 1,000-seat theaters.

THE cost of an air conditioning system employing refrigeration cannot very well be absorbed in the construction costs of a small theater, particularly the 200- to 400-seat theater. It represents too large a share of the entire outlay for the building and installation. However, since some cooling must be provided during the summer months as a means to provide attendance, theater owners and operators have resorted to simple ventilation.

Not only is the cost brought down to the limited budget on which the small theaters operate, but both the installation and the operation of the system has been simplified as compared with the conventional air conditioning layout.

Details of simple ventilating systems for theaters having seating capacities from 1,000 seats down to 400 seats were presented in an article published in the November, 1950 issue of HEATING AND VENTILATING. This article covers the ventilating system design and the problems that are peculiar to the theater having from 200 to 400 seats. While the ventilating design is much simpler than for a system to be installed in the larger theater, there are some basic data to be followed for efficient operation.

Design for 200- to 400-Seat Theaters

Small theaters, from 200 to 400 seats, present a number of special problems in laying out the ventilating system. These small theaters operate on a very limited budget and cannot afford the conventional blower-system method of ventilation. Accordingly, the only type of equipment readily available is the typical exhaust fan which must be used in the best possible manner for ventilating the theater. It has been found, from past experience, that an exhaust air system of ventilation works best in most small theaters, especially in farming communities.

The usual practice is to install a two-speed exhaust fan at each side of the screen platform, Fig. 1, with a short run of duct from the opening in the rear wall to the grille at the proscenium opening. A short run of duct is installed at each side of the projection room, from the front wall of the theater to the rear wall of the auditorium. In some cases, booster fans are in-

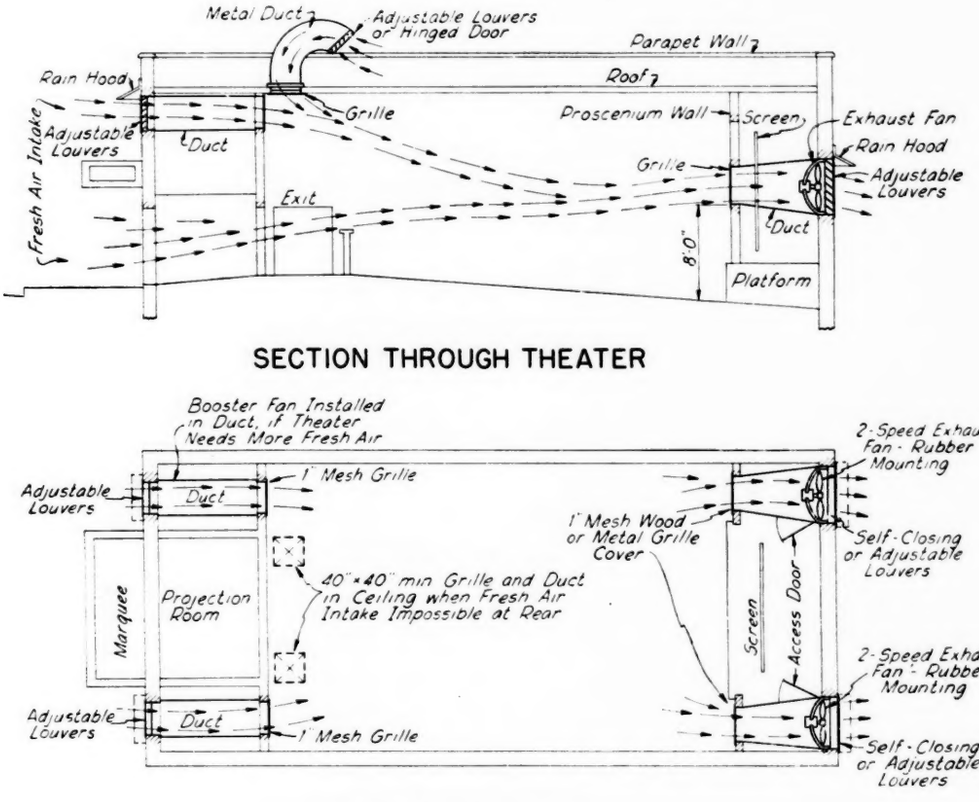


Fig. 1. Theater plan and section of a ventilating system designed to serve a theater containing from 200 to 400 seats.

stalled in these ducts to help pull in the fresh air to the auditorium. The main idea is to pull out the hot, stale and mostly foul air from the theater instead of pushing it out through the lobby doors and into the street.

Where it is impossible or impracticable to have openings and ducts alongside the projection room for fresh air intake, then openings should be cut into the roof at the rear of the auditorium, and metal ducts run from them to the outside. These ducts should be properly curved at the ends, and either adjustable louvers or hinged doors installed for opening or closing the vent.

With this type of exhaust system, no such appreciable cooling effect can be expected as with a blower system, for a small amount of air will be moving at a slow speed. A typical exhaust fan is not designed for large capacities of air, especially when working against back pressure. In these exhaust-ventilating systems, exhaust fans of the latest and best design, quiet in operation, should be installed. These fans should have two-speed control and be able to handle reasonably large capacities of air at slow speeds, with the noise level kept to the minimum. For the average 300-seat theater two exhaust fans should be installed, each having 11,000 cfm capacity at high speed and 8,000 cfm at low speed.

Size of openings in the walls and size of the ducts for each such fans should be approximately 44 inches square. Over each opening, a substantial metal rainhood with about a one-inch mesh screen should be installed. Also, wherever possible or practicable, self-closing louvers should be installed at the exhaust ends and hand adjustable louvers at the fresh air intake openings. Ductwork can be of celotex, at least ½ inch thick, properly reinforced. For the better installation, only metal ducts should be used. This type of exhaust system could be reversed so that the air flow is from the stage end, over the auditorium to the rear, and out the lobby doors or partly through the fans at the rear. However, many theater owners will not tolerate the objectionable odors at the entrance, regardless of how well the air movement is within the auditorium.

Installation and Service Suggestions

These thirteen pointers apply not only to the small or 200- to 400-seat theater but to the 1,000-seat theater as well. The suggestions are not difficult to follow or to incorporate as standard practice.

The following can be a source of information and reminder on the care, servicing and installation of a fan or blower in the average simple ventilating system.

(1) To avoid the possibility of having a noisy ventilating system due to excessive high speeds or velocities, the drive motor should operate from 1,200 to 1,800 rpm and the supply blower from 150 to 350 rpm.

(2) Always make sure that adequate provisions are made in the blower room for hoisting and inserting the blower, coils and air-washer. In a lot of cases, after the blower room is completely finished, it is found that the opening left in the wall is not large enough to permit the blower or other equipment to go through.

(3) Try to avoid taking a blower apart to get it through narrow passage ways. Even experienced ventilating men will have trouble assembling the unit to match that made at the factory.

(4) Before starting the system, make sure blower and motor bearings are greased or oiled with lubricant recommended by the manufacturer. Many bearings have been ruined because the installation men assumed the manufacturer had oiled or greased his equipment at the factory. A good practice is to pour a good light grade of oil into the blower grease cup before forcing in heavy grease. In this way, the oil will provide a smooth path for the grease to follow.

(5) Be certain that a metal drip pan is installed under the motor base and possibly under the blower bearing blocks to catch the overflow of oil or grease. Without these pans, the overflow oil or grease will soak into the floor and will constitute a fire hazard.

(6) Make sure that the fan or blower room is always clean and free of sticks, paper, and similar items. Such articles have a way of entering working parts of the fan, blower, or motor to cause damage.

(7) See that all nuts on bolts or screws are tightened with a screw driver or wrench, even if they seem to be all right. One or two could have been missed in the final examination.

(8) Thoroughly check the canvas connection between the mouth of the blower and the duct. Always remember that a loosened or defective connection can lose a lot of air.

(9) Double check the fastening of the blower and motor to the floor—if need be, by pushing strongly against them to detect any slight movement. Any loose fastening bolts or base can cause rattling noises and perhaps serious misalignment of the pulleys and drive belts.

(10) Check the drive belts for any excessive looseness. Drive belts should not be stretched too taut on the pulleys, for this results in a strain on the fan or blower shaft and bearing housing. A quick check can be made by slapping the top of a belt with the palm of the hand. If the belt rebounds with a jerk, it is stretched too tight.

(11) It is very important that pulleys are set solid on the shafts. Loose pulleys are the chief cause of rapid belt wear, scoring of bearing race, and misalignments. Make sure that pulley grooves are always smooth; any sharp burrs or rough spots should be filed smooth. For tightening pulleys to the shaft, use only the proper wrench, Allen wrenches are commonly required, and go over the set screws several times after the test runs of the blower.

(12) For checking the pulley alignment, use only a long straight-edge and have it handy in the blower room for use in future servicing. When using this straight-edge, make sure that the straight-edge rests evenly against the outer diameters of motor and blower pulleys. Check both faces of the pulleys.

(13) Blower and motor bases should not be fastened down with defective holding bolts—ones with crossed or sheared threads. A job of this sort will mean a constant source of headaches later on in adjustment work.

If I Were an Advertising Man

HARRY TERRY
Consulting Engineer, New York, N. Y.

Usable product information is what the author wants in advertising and sales literature. His own opinions are expressed, and comment is invited.

SOME years ago the Cutler-Hammer Company, manufacturers of electrical controls, found out by an extensive telephone survey of its customers that the executives it wished to reach through advertising received on the average 23 publications a month, looked over five and read two. No doubt other manufacturers have also learned that their customers, too, are flooded with sales messages they do not have time to read. My experience as a consulting engineer depending for technical information on the advertising of the companies manufacturing the equipment I specify leads me to believe not only is it impossible to read the advertising I receive but altogether too much of it is inappropriate. I am surfeited with too much advertising technique and not enough product information in the form I can readily use. I'd like to see a series of advertisements, bulletins and booklets describing the products I specify, which would not try to excite an interest already keen, but rather would show me how to fit the product into the systems I design, how to specify it, how it should be serviced and what would be its cost installed and ready for use. Probably most manufacturers think that is just what their sales promotion department does today! But is it?

Give Information on Product and Allied Equipment

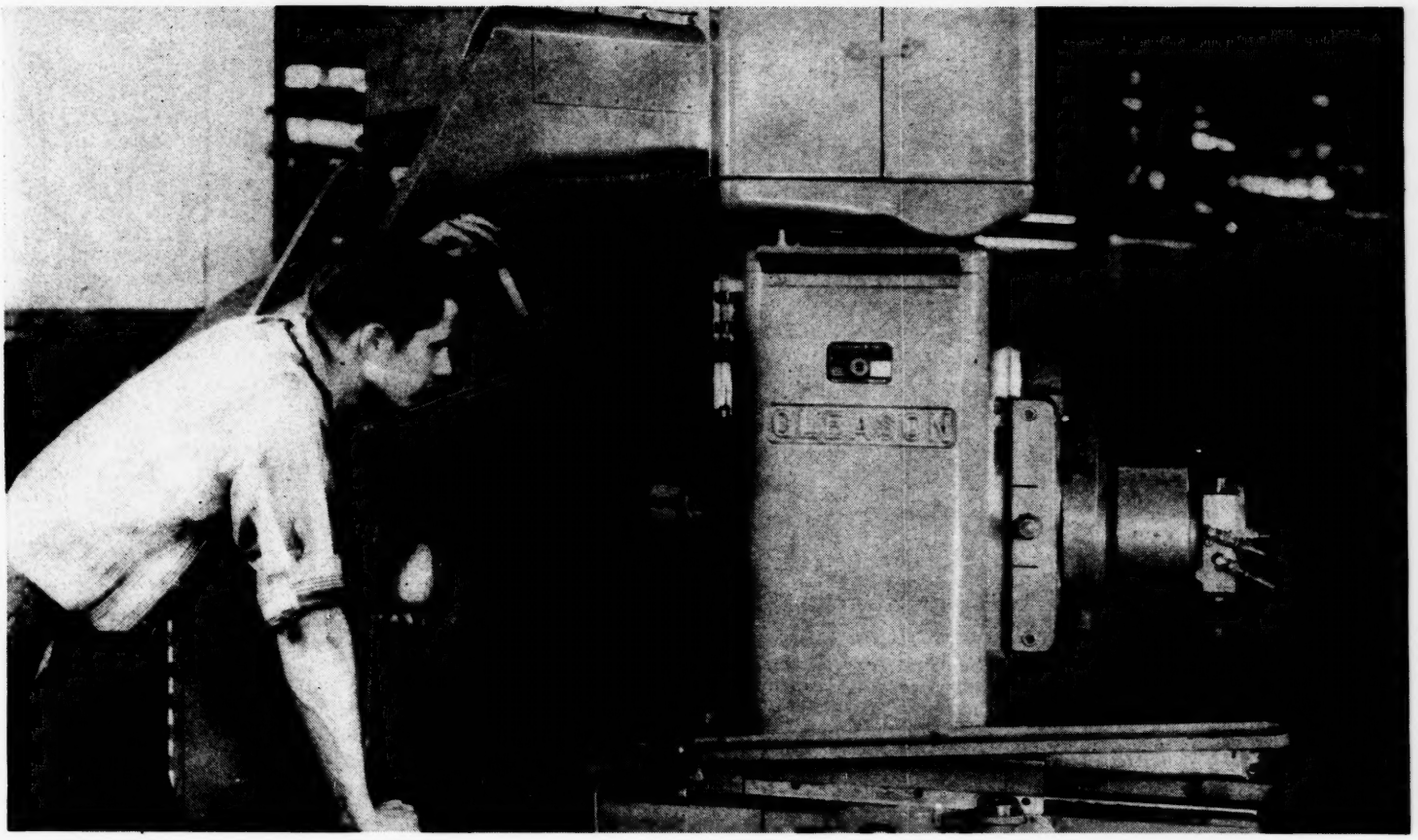
Take, as an example, a centrifugal pump to be used as a house pump—what manufacturer has provided the following information which is pertinent and of immediate use to a designer of plumbing systems for buildings large and small:

Capacity of pump; appropriate size of house tank (both gravity and pneumatic); motors for different heads; appropriate type of controller; and, for pneumatic systems, capacity of air compressor, motor and controller. Yet all those data must be coordinated if the house pump is to give satisfactory service. The designer makes his selection of such a pump based on his estimate of the water requirements of the building, from whatever data he may have, picks a motor to drive the pump assuming a combined efficiency of the pump and motor, selects an appropriate control from some control manufacturer's catalog and writes a specification covering the assembly. Having gone through this lengthy process once, is it any wonder he uses this specification over and over again instead of considering the advantage of using a pump he may see advertised in general terms in the trade press. But assuming the pump manufacturer's advertising is effective enough to overcome the designer's natural inertia or indolence, he is at once confronted with the problem of writing a new specification covering the pump he has seen advertised and thinks he would like to use. Here again the manufacturer's literature fails to give him the desired assistance. Manufacturers' specifications are either too long or too thin and need rewriting to include only the information a bidder needs to make his estimate, and only what the designer needs for reference when competitive pumps are presented for consideration by the successful bidder.

Catalog Copy

If I were an advertising man I'd make a careful study of both Sears & Roebuck and the Montgomery-Ward catalogs. These manufacturers give such detailed information of their products that a customer can order with complete confidence that the equipment when delivered will meet his needs fully, and at the same time the catalog copy is so succinct that the resulting orders from customers pay well for the advertising space used. I'd learn to make my advertising copy sell directly or indirectly the products my company had for sale by including full product information. Publications are bought for their editorial content, not for their advertisements. So I'd learn from editorial content what interested readers and I'd embody in my copy only elements close to the readers' interest. Human interest illustrations, bold display lines, white space, color and so forth, attract attention to themselves, but only in rare instances do they sell me on the products I specify. So I'd write the text-matter of my advertising from the readers' viewpoint to educate him and make its reading worthwhile because of its store of useful, practical knowledge. For I think advertising should be written from the user toward the product rather than the reverse.

Much technical advertising is written to stimulate requests for product catalogs. If I were an advertising man, I should not be satisfied with what I *thought* should be included in such sales literature, nor would I be satisfied my sales manager had all the answers. I'd follow the old Packard slogan and "Ask the Man Who Asked for a Catalog" what he expected to find in it—enough answers from the catalog users would shape my catalog format, write its context, select its illustrations and govern its slanting. As a consulting engineer, I have experience which is typical of all engineers and I believe we all would be glad to pass along to any reputable manufacturer our experience as it relates to his sales and advertising problem. But I know of no manufacturer who conscientiously seeks to fill the needs of the consulting engineer as the engineer himself views them. So, if I started to survey the market for catalogs I'd expect an enthusiastic response from engineers. And, as well as improving advertising, some unusually effective sales manuals might be built from such a survey, too.



Foote Gear Works, Chicago, Ill.

Fig. 1. Plastic enclosures provide visibility and also constitute excellent splash guard and exhaust hood construction for this gear grinder.

Scrapbook of Exhaust Hood Design

Part 6—Control of Oil Mist from Machines

JOHN M. KANE

Chief Engineer, Dust Control Division, American Air Filter Co., Louisville, Ky.

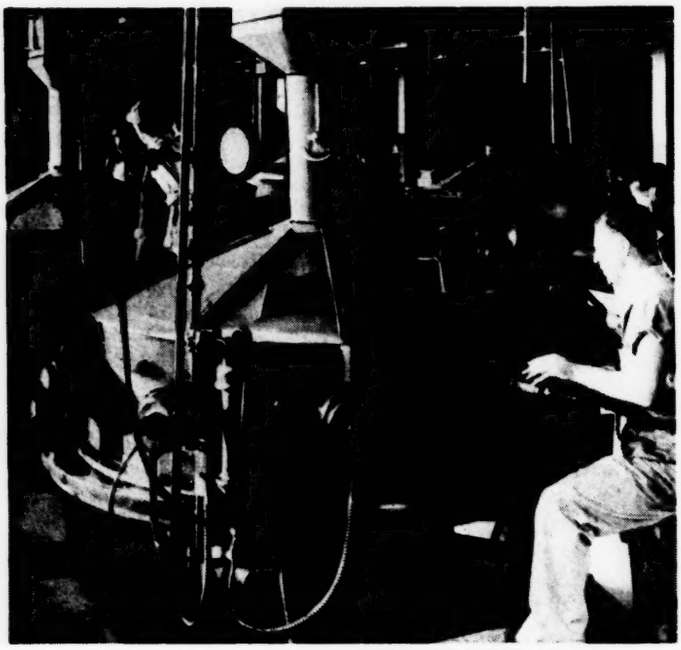
THE problem of oil mist generation has become more evident with the increased use of higher speed finishing machinery and the increasing tendency to use oil as a coolant for such operations. Without local exhaust ventilation, workrooms can become filled with an oil haze; condensation on the floor introduces a distinct safety hazard, and condensation on walls and ceiling can cause a real fire hazard.

An exhaust hood must be designed so the machine can be serviced and operation observed when required. Hood sides must act as splash guards, as an indraft of air will not stop the oil throw from the operation. Machine tool manufacturers have met the problem with plastic enclosures, such as Fig. 1 and 2, designed so operation can be observed and the hood readily opened or moved for placing and removing of parts machined.

Where such hooding has been overlooked by the manufacturer, it is usually possible to construct suitable enclosures. The hood design for the automatic screw machines, Fig. 3, illustrates the enclosure principally involved. An exhaust of 600 cfm from the top

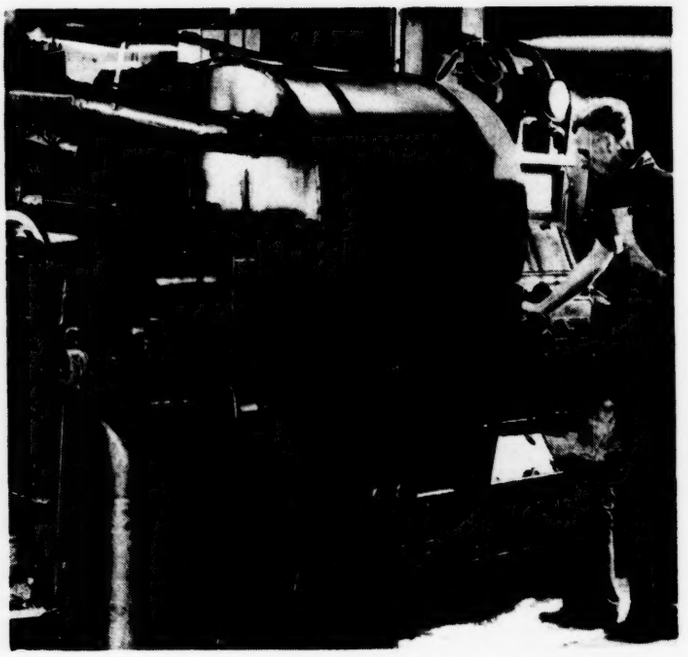
Jones & Lamson Machine Co., Springfield, Vt.

Fig. 2. The enclosure for this automatic lathe has simplified oil mist control.



Bridgeport Brass Co., Bridgeport, Conn., and Delbrook Ventilating, Cambridge, Mass.

Fig. 3. The ventilating engineer designed an excellent enclosure for this screw machine used for making tire valve stems.

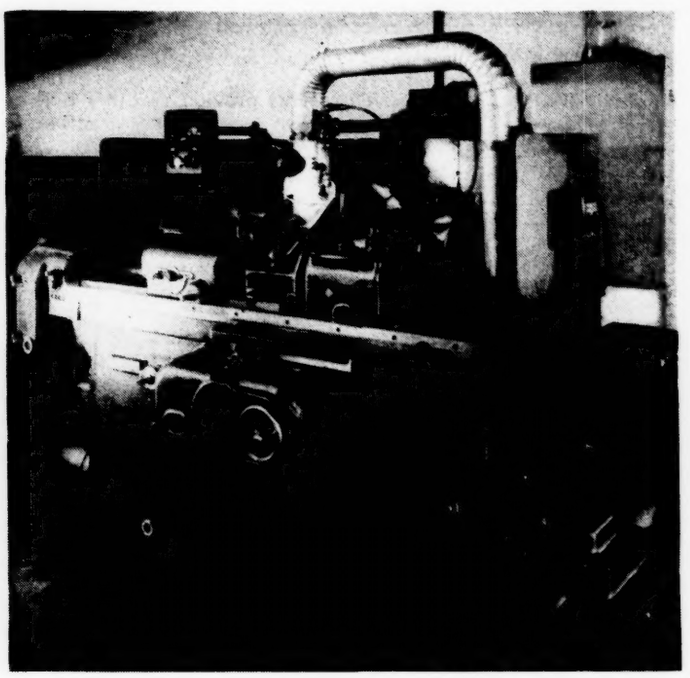


Wolverine Brass Co., Grand Rapids, Mich.

Fig. 4. A complete enclosure was constructed for this screw machine operation by adding end shields and extending the splash guard.

Wolverine Brass Co., Grand Rapids, Mich.

Fig. 5. Another detail of Fig. 4. Enclosure is hinged at the top and rests on splash guard when in the closed position. Access to the machine is quickly obtained.



Dale Service Co., Houston, Tex.

Fig. 6. For some operations, like this thread grinder, small local hoods are practical.

of each hood is ample to confine the mist and vapors released and prevent their escapement to the room. Fig. 4 shows equally effective hooding designed for another type of screw machine. Exhaust duct locations can be noted. Accessibility to the machine is built into the hood, Fig. 5, by the formed section hinged at the hood top.

In some cases, like the thread grinder, in Fig. 6, hooding can be localized and provided in the form of loose fitted parts serving both as splash guards and as means for reducing the opening through which an indraft must be maintained for proper mist control.

For most machine tools, an exhaust volume of 400 to 600 cfm will provide the recommended 100 fpm indraft and will prevent vapor and mist from dispersing if care is exercised in the hood construction. However, control may require volumes of 1,000 to 1,500 cfm where considerable heat is generated in the operation, or where hooding is compromised. Conveying velocities in ducts of 2,500 fpm is ample, but care should be taken to make duct joints tight. Ducts should be pitched to allow condensed mist and droplets to drain back to the respective machine tool or to a special container.

Methods for Supporting Pipe

J. E. YORK
Building Service Engineer, Stone & Webster Engineering Corp.

Part 8 of a group of articles that describes and illustrates the various means for supporting pipe lines. This article covers anchors and guides for lines conveying heated fluids or steam.

STEAM lines or other lines used for conveying heated fluids commonly must be anchored to prevent longitudinal movement and also frequently to prevent transverse movement.

Before welded pipe lines were commonly used, anchorage against longitudinal movement was generally obtained by means of wrought iron pipe clamps which were tightly bolted around the pipe and rigidly fastened to the building steel or the masonry structure by two bars or rods which prevented movement in either direction.

Where it is also necessary to anchor against transverse movement, the two anchor rods can be installed at an angle to the run of the pipe on opposite sides, or four rods installed.

Anchor chairs, Fig. 117, were sometimes used with wall brackets, or if the pipe were conveniently located, mounted directly on the structural steel. Where they were mounted on brackets, tie-rods were generally extended diagonally from the outside edge of the bracket to the walls, as shown in Fig. 118.

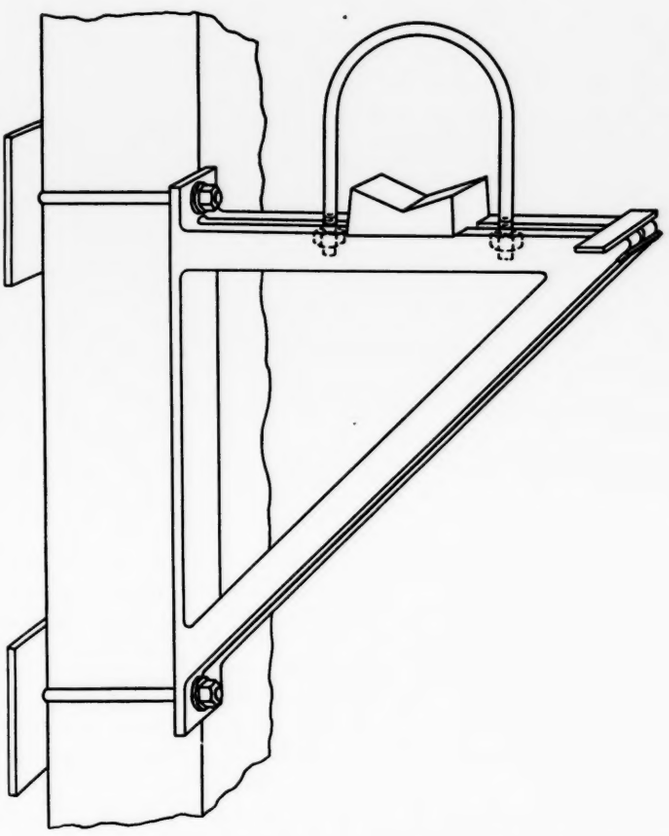


Fig. 117. Anchor chair used with a wall bracket.

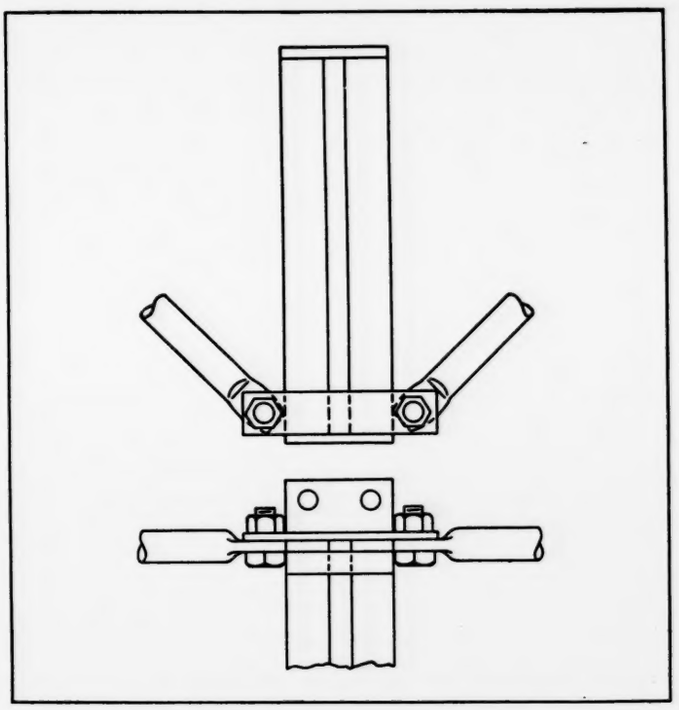


Fig. 118. Arrangement of tie-rods from bracket to walls.

In Fig. 119, an improved type of anchor chair is shown which has lugs to permit direct attachment of the tie-rods to the anchor chair, thus reducing the stress on the brackets.

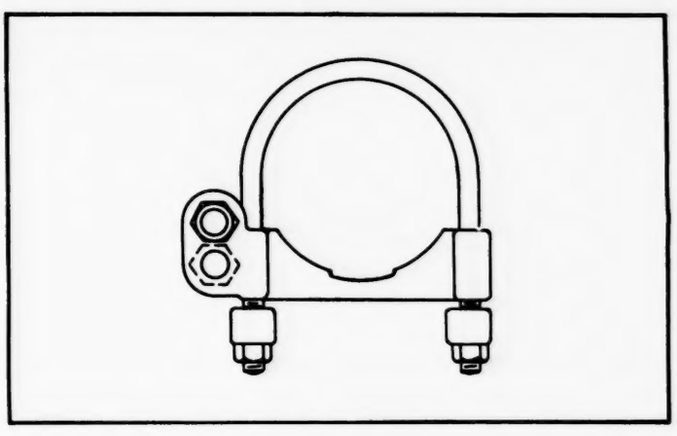


Fig. 119. Details of an anchor chair with lugs for attaching tie-rods.

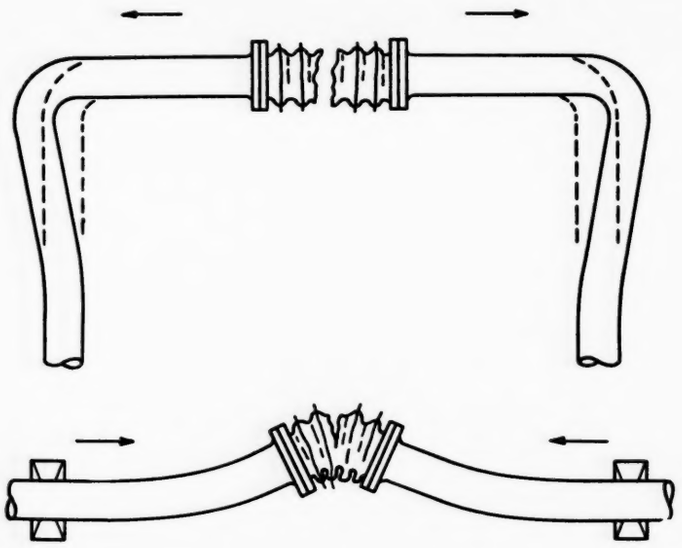


Fig. 120. Importance of guiding movement due to expansion. Top, effect of thrust from internal pressure without anchors. Center, effect of thermal expansion without guides. Bottom, proper alignment of anchors and guides.

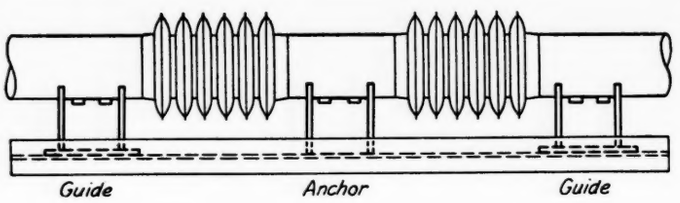


Fig. 121. Double expansion joint with center anchor and end guides.

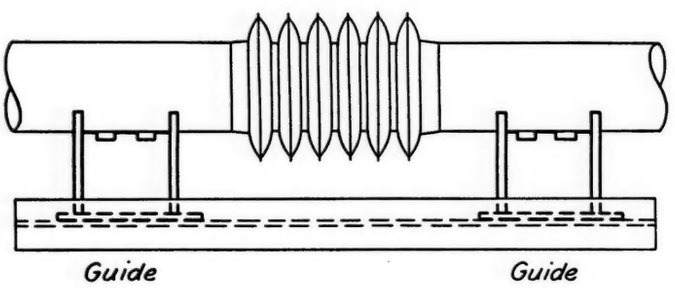


Fig. 122. Single expansion joint with two guides.

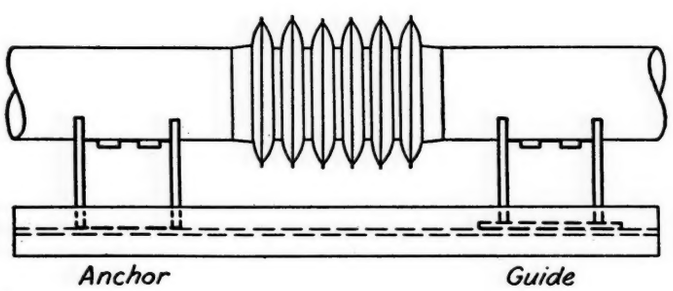


Fig. 123. Single expansion joint with one anchor and guide.

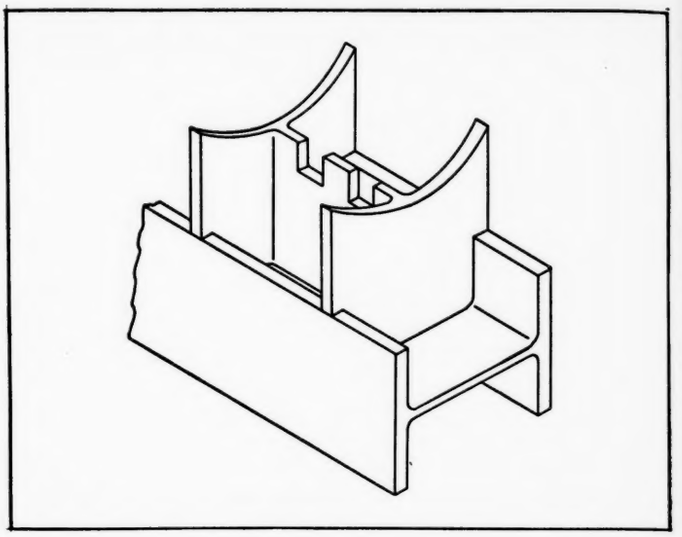


Fig. 124. Sectional view of anchor.

With the common present-day piping practice of welding piping systems, a pipe line may be anchored against movement by welding a piece of heavy steel plate lengthwise with the pipe and to the building steel, if conveniently located, or the rods as previously described may be welded directly to the pipe.

Where bellows or sliding type expansion joints are installed in a piping system, it is not only necessary to anchor the pipe against movement at the selected anchor points, but it is desirable to guide the movement of the pipe due to expansion, in order to prevent rupture of bellows type joints or binding of sliding joints, as shown in Fig. 120. A double expansion joint

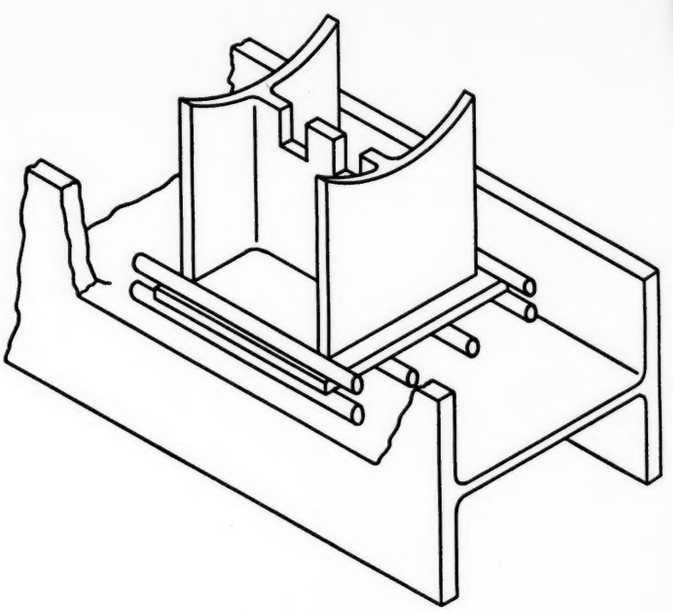


Fig. 125. Sectional view of guide.

with a center anchor and a guide on each side is shown in Fig. 121; a single expansion joint with two guides, Fig. 122; a single expansion joint with an anchor and guide, Fig. 123; and details of construction of both anchor and guides, Fig. 124 and 125.

Part 9 will cover supports for pipe lines in tunnels.

Moisture Condensation on Enclosed Show Windows

THEODORE L. GERSHUN

Courtesy, Lerner Shops

Fig. 1. Attractive displays behind clear windows promote sales. Special warm air outlets are installed in these windows to prevent moisture from condensing on the glass.

Moisture Condensation on Enclosed Show Windows

THEODORE L. GERSHUN

Methods of preventing moisture condensation on the inside of windows of enclosed display areas are discussed and data presented to show under what conditions condensation will develop. This study was undertaken as a partial requirement for the degree of Master of Science in Mechanical Engineering at the University of Washington, Seattle, Wash., under the direction of Prof. H. M. Hendrickson.

THE problem of moisture condensation on windows is one which has been encountered in business places for many years. Numerous solutions for the problem have been offered, some of which have been practical and many more impractical.

In this study of the problem of moisture condensation on show windows, the investigation was devoted to closed display areas in retail stores. Trends at the present time, however, particularly with respect to suburban localities, are toward show windows which do not have a closed display area. These look-through windows, which allow one to see not only the particular displays, but also the store interior, present a somewhat different approach to the problem of the moisture condensation on the windows than is offered here.

The store itself is presented to the public through its show windows, and therein lies the opportunity to create the desire for the public to buy.

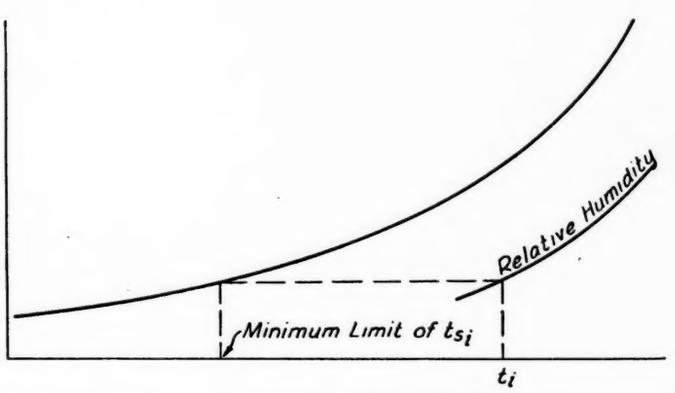


Fig. 2. Skeleton psychrometric chart.

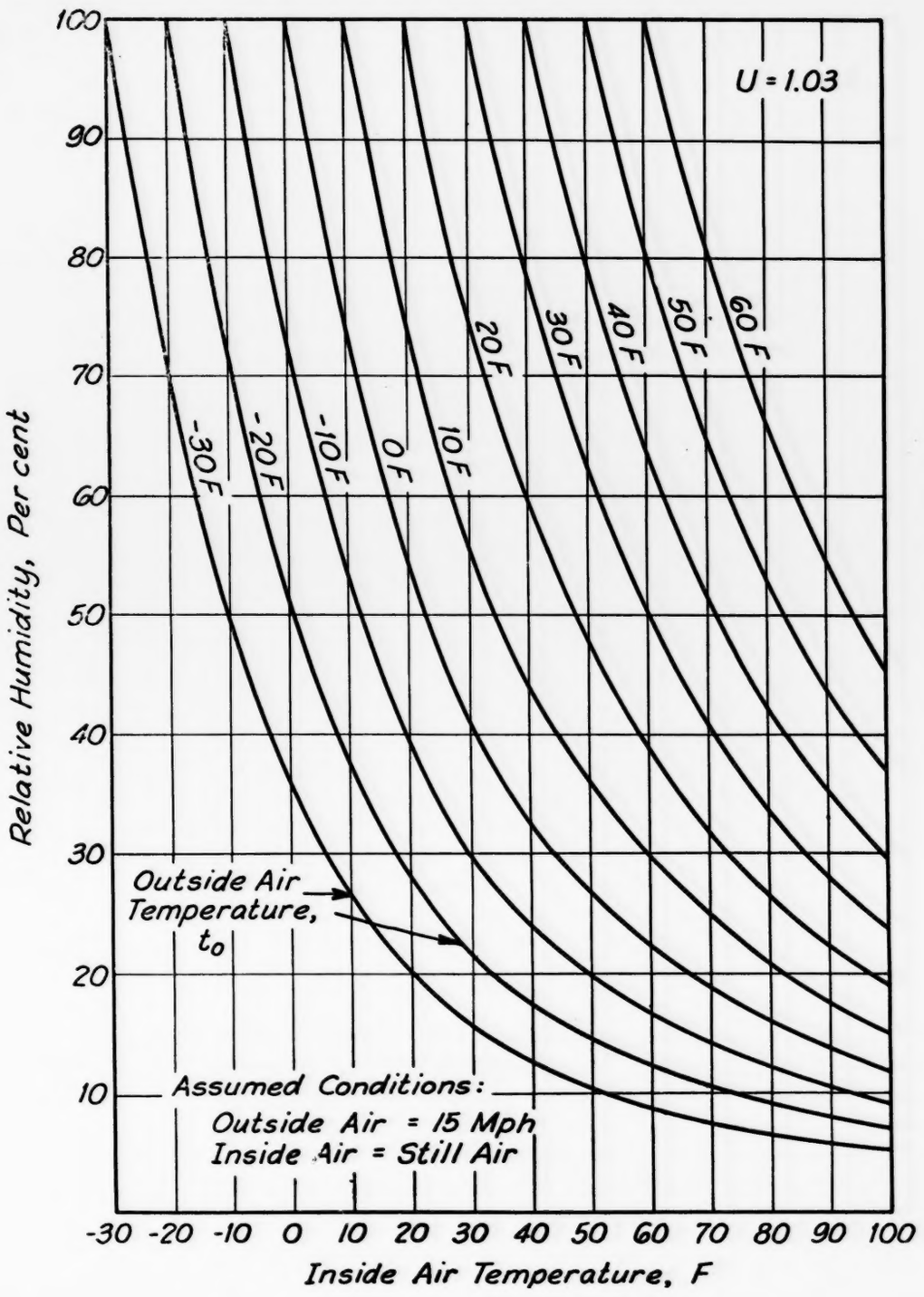


Fig. 3. Inside relative humidity at which condensation will occur on plate glass for a given inside and outside temperature.

These windows must be clean and free from visual obstructions at all times if they are to perform their prescribed duties. Stores of today have large windows which must be frequently cleaned both inside and out to remove the dirt and surface film which result from normal exposure to the environment. Cleaning the outside surface of the windows is not a difficult job, and can be done early each morning before the the store opens for business. However, if the inside surface of a window should become spotted and streaked with dirt, it is not as simple to clean, for the displays would have to be disturbed and general disarray would result.

Inside surfaces of show windows are generally not in need of as frequent cleaning as is the outside because the environment is clean and air motion for movement of dust is very slight. On the other hand, should the windows at any time have moisture condensing on the inside, visual obstruction develops and the surface becomes streaked when the moisture is dried.

Moisture condensation on show windows is the result of the air enclosed in the window display area having water vapor as a constituent of the air. This vapor usually occurs in the form of superheated steam, but when the air comes in contact with a surface cold enough to be below the dew point of the air, moisture will condense on the cold surface. For this reason, if the inside surface temperature of a window is below the dew point temperature of the inside air, moisture condensation is likely to occur on the window. To be sure that moisture condensation does not take place, the inside surface temperature of the window (t_{s1}), Fig. 2, should not be less than the dew point temper-

TABLE 1—INSIDE AIR TEMPERATURE (t_i) WHICH WILL YIELD A WINDOW SURFACE TEMPERATURE (t_{si}) FOR PLATE GLASS

t_o, deg F	Inside Surface Temperature of the Window, t_{si}, deg F														
	— 30	— 25	— 20	— 15	— 10	— 5	0	5	10	15	20	25	30	35	40
— 30	— 30	— 16.7	— 3.4	9.9	23.2	36.5	49.8	63.1	76.4	89.7	103.0				
— 20			— 20	— 6.7	6.6	19.9	33.2	46.5	59.8	73.1	86.4	99.7	113.0		
— 10					— 10	3.3	16.6	29.9	43.2	56.5	69.8	83.1	96.4	109.7	
0							0	13.3	26.6	39.9	53.2	66.5	79.8	93.1	106.4
10									10	23.3	36.6	49.9	63.2	76.5	89.8
20											20	33.3	46.6	59.9	73.2
30													30	43.3	56.6
40															40
50															
60															

ature at the existing conditions of inside temperature (t_i) and relative humidity.

Air Relationships

Naturally, the inside temperature and relative humidity in a window display area and the outside temperature will vary from day to day. It is therefore necessary to be able to show just when moisture condensation can be expected for a particular outside temperature and for any temperature existing inside the window display area. For this reason the curves of Fig. 3 were drawn.

These curves were determined mathematically, making the following two initial assumptions:

(1) Outside wind velocity, 15 mph; inside air = still air.
(2) The window consists of a plate glass window having a coefficient of heat transmission U = 1.03.

Using these assumptions, the required inside air temperature was calculated which would yield a given inside surface temperature for a fixed outside temperature. This was accomplished by using the relationship:

$$\frac{R_1}{R_2} = \frac{(t_i - t_{si})}{(t_i - t_o)} \qquad (1)$$

Where:

R_1 = Resistance to heat flow from the inside air to the window surface $= \frac{1}{f_i}$

R_2 = Resistance to heat flow from the inside air to the outside air $= \frac{1}{U}$

t_i = Inside air temperature, F
t_{si} = Inside surface temperature of the window, F
t_o = Outside air temperature, F
f_i = Inside air film coefficient of heat transmission = 1.65
U = Over-all coefficient of heat transmission for a plate glass window = 1.03 for a wind velocity of 15 mph

The relationship is shown in Fig. 4.

Substituting the fixed values of R_1 and R_2 into Equation (1) and solving for t_i, Equation (1) appears as

$$t_i = 2.66\ t_{si} - 1.66\ t_o \qquad (2)$$

Equation (2) was then solved for t_i using different values of t_{si} and t_o, the results being tabulated in Table 1.

For each value of t_o in Table 1 the value of the saturating vapor pressure was recorded in Table 2 for every value of t_{si}. For these related temperatures, the corresponding values of t_i were listed. Also, the value of specific humidity at the saturation point was recorded at each value of t_{si}. The relative humidity of the inside air at which condensation will occur for a given t_o and every t_i was then calculated and recorded in this table. The relative humidity was calculated from the equation

$$\text{R.H.} = \frac{\text{V.P. at } t_{si}}{\text{V.P. at } t_i} \qquad (3)$$

Where:

R.H. = Per cent relative humidity inside the display spaces at which condensation will occur.

V.P. = Saturating vapor pressure at the indicated temperature of t_{si} and t_i.

Equation (3) is valid, since relative humidity is de-

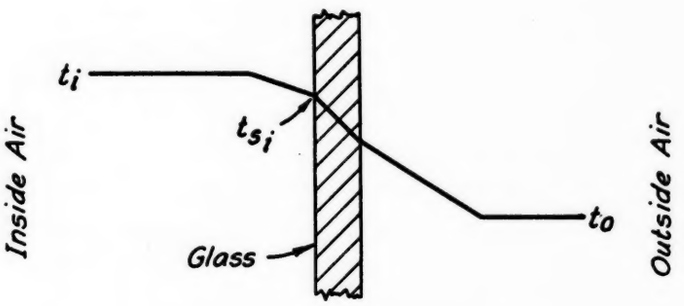


Fig. 4. Temperature gradient as related to inside and outside air conditions.

WINDOWS FOR A GIVEN OUTSIDE TEMPERATURE (t_o)

45	50	55	60	65	70	75	t_o, deg F
							— 30
							— 20
							— 10
							0
103.1							10
86.5	99.8	113.1					20
69.9	83.2	96.5	109.8				30
53.3	66.6	79.9	93.2	106.5			40
	50	63.3	76.6	89.9	103.2		50
			60	73.3	86.6	99.9	60

fined as the ratio of actual vapor pressure under the existing conditions to the vapor pressure to cause saturation. The air existing at t_1 will be reduced in temperature to t_{s1} when it comes in contact with the window surface (even though the specific humidity will remain the same) and thus, the saturating vapor pressure at t_{s1} is the limiting condition for condensation to occur. This is the same thing as saying that when t_{s1} is at or below the dew point temperature of the enclosed air, then condensation will take place on the window surface. See Fig. 2.

The values of relative humidity in Table 2 were plotted at every condition of t_1 for each of the values of t_o, and the curves of Fig. 3 resulted. These curves can be used directly to determine the maximum allowable relative humidity which can exist at a given inside temperature when the outside temperature is expected to reach a certain minimum.

As an example, suppose that in the city of Chicago, Ill., where the design dry bulb temperature for the winter months is —10F, a show window display area has a normal average temperature of 58F. From the curve for t_o = —10F, it is seen that the maximum allowable relative humidity is 17% at an inside temperature of 58F. On the other hand, if the outside temperature should rise to 30F, the allowable relative humidity would be 52%.

The low value of allowable relative humidity indicated in the above example shows a need for some type of control to take care of possible moisture condensation on the colder days of the year. The problem of control of the air temperature and relative humidity inside the display areas of show windows is one of many varied factors. These display areas are subjected to a wide variety of conditions within one store and the controlled variables would be subject to vast changes in requirements for one window as compared to another. Also, one window alone may have different conditions existing from one week to another due to change of displays.

As an aid in using the curves of Fig. 3, another set of curves, Fig. 5, was drawn to show the variation of allowable specific humidity with inside air temperature for given values of outside temperatures. These curves were drawn on semi-logarithmic graph paper because it was noticed that the variation of specific humidity was approximately a straight line when plotted logarithmically versus a linear variation of the inside air temperature. Due to this type of variation, the values of specific humidity to cause condensation at the higher temperatures could be shown more accurately without loss of accuracy at the low temperatures. These curves are helpful in determining the amount of moisture contained in circulated air from the main heating plant which can be allowed to enter the display areas.

Survey of Leading Department Stores

In the investigation of the problem of moisture condensation on show windows it was decided that information should be gathered directly from those who are actually confronted with the problem. This was accomplished by sending a questionnaire to 50 of the larger department stores located in cities in the northern half of the United States.

The questionnaire was prepared with the aim of acquiring the answers to certain particular questions rather than requesting general information which may or may not have been of value. Most of the questions could be answered by "yes" or "no" or another answer quite as brief. In this way it was thought that a greater response would be gained since very little time would be required to fill in the answers. The following is a copy of the questionnaire with a summary of the answers received. The summary of answers is given in terms of a percentage of those answering the particular question. Naturally, not all the questions were answered on all of the returned questionnaires.

The response to the questionnaire was good, yielding a total return in excess of 66%.

The majority of the returned questionnaires indicated that very little difficulty was encountered due to moisture condensation on show windows. However, those who did indicate that no trouble was encountered, also indicated the precautionary measures which were observed in preventing warm humid air from coming in direct contact with the cold window surface.

Questionnaire

1—(a) Do you encounter difficulty with moisture condensation on show windows during certain periods of the year?

Yes, 20%; no, 80%.

(b) If the answer to 1—(a) is yes, during what months of the year does moisture condensation usually occur? (Underline the months.) Jan. Feb. March April May June July Aug. Sept. Oct. Nov. Dec.

All answers indicated December, January and February; those who were in the colder areas also included November and March.

2—(a) Is the air entering the show window spaces heated?

Yes, 40%; no, 60%.

(b) If the answer to 2—(a) is yes, what is the temperature of the air entering the spaces? ..... deg F.

68-74F, 58%; 75-80F, 28%; other, 14%.

TABLE 2—RELATIVE HUMIDITY AT WHICH CONDENSATION WILL OCCUR FOR PLATE GLASS WINDOWS

t_{s1}**, deg F	Outside Air Temperature, t_o*, deg F									
	— 30	— 20	— 10	0	10	20	30	40	50	60
— 30 0.00344 1.0206	— 30 0.00344 100									
— 25 0.00465 1.3376	— 16.7 0.00746 62.4									
— 20 0.00620 1.8375	— 3.4 0.01545 40.1	— 20 0.00620 100								
— 15 0.00823 2.4388	9.9 0.0307 26.8	— 6.7 0.01295 63.5								
— 10 0.01086 3.2186	23.2 0.0588 18.5	6.6 0.0260 41.7	— 10 0.01086 100							
— 5 0.01424 4.2210	36.5 0.1060 13.4	19.9 0.0502 28.4	3.3 0.0220 64.9							
0 0.01853 5.500	49.8 0.1767 10.5	33.2 0.0929 20.0	16.6 0.0428 43.4	0 0.01853 100						
5 0.0240 7.12	63.1 0.286 8.4	46.5 0.1562 15.3	29.9 0.0804 29.9	13.3 0.0365 65.9						
10 0.0309 9.18	76.4 0.450 6.9	59.8 0.254 12.2	43.2 0.1377 22.4	26.6 0.0690 44.9	10 0.0309 100					
15 0.0396 11.77	89.7 0.692 5.7	73.1 0.403 9.8	56.5 0.226 17.5	39.9 0.1211 32.7	23.3 0.0590 67.1					
20 0.0505 15.01	103.0 1.039 4.9	86.4 0.623 8.1	69.8 0.361 14.0	53.2 0.200 25.3	36.6 0.1065 47.4	20 0.0505 100				
25 0.0640 19.05		99.7 0.941 6.8	83.1 0.561 11.4	66.5 0 322 19.9	49.9 0.1774 36.1	33.3 0.0934 68.5				
30 0.0808 24.07		113.0 13.90 5.8	96.4 0.851 9.5	79.8 0.504 16.0	63.2 0.287 28.2	46.6 0.1567 51.6	30 0.0808 100			
35 0.100 29.83			109.7 1.264 7.9	93.1 0.769 13.0	76.5 0.452 22.1	59.9 0.255 39.2	43.3 0.1382 72.4			
40 0.1217 36.36				106.4 1.149 10.6	89.8 0.694 17.5	73.2 0.405 30.0	56.6 0.227 53.6	40 0.1217 100		
45 0.1475 44.14					103.1 1.042 14.1	86.5 0.625 23.6	69.9 0.362 40.8	53.3 0.201 73.5		
50 0.1780 53.38						99.8 0.944 18.9	83.2 0.563 31.6	66.6 0.323 55.1	50 0.178 100	
55 0.214 64.34						113.1 1.394 15.3	96.5 0.854 25.1	79.9 0.505 42.4	63.3 0.288 74.4	
60 0.256 77.21							109.8 1.268 20.2	93.2 0.772 33.2	76.6 0.453 56.6	60 0.256 100
65 0.305 92.4								106.5 1.152 26.4	89.9 0.696 43.9	73.3 0.406 75.1
70 0.363 110.2									103.2 1.045 34.8	86.6 0.627 57.9
75 0.430 131.1										99.9 0.947 45.4

*Upper number = t_1, deg F, corresponding to t_o and t_{s1}. Middle number = saturating vapor pressure lb per sq in. at t_1. Lower number = relative humidity at which condensation will occur for corresponding t_1 and t_o.

**Upper number = t_{s1}, deg F. Middle number = saturating vapor pressure lb per sq in. at t_{s1}. Lower number = saturating specific humidity (grains per pound of dry air) at t_{s1}.

3—(a) Is the air entering the show window spaces directed on the windows?

Yes, 8%; no, 92%.

(b) If the answer to 3—(a) is yes, does the air enter from below or from above the window?
Below, 30%; above, 30%; all around, 40%.

(c) If the answer to 3—(a) is no, where does the air enter the show window spaces (rear, side, front, top, bottom, etc.)?
Rear top, 28%; rear sides, 44%; seepage only, 28%.

4—(a) Is the air which enters the show window spaces dehumidified (moisture removed) before it enters the show spaces?

No, 86%; yes, 14%.

(b) If the air is dehumidified, is it done by passing the air through an air drier using a chemical for absorbing the moisture?
If so, what chemical is used and what is the manufacturer's name and designation of the unit?

None.

(c) If the air is dehumidified, is it done by refrigeration?

Yes, 100%.

If so, to what temperature is the air cooled? ..... deg F.
Dew point 50-55F, 50%; 40-50F, 16%; unknown, 34%.
If the air is cooled, is it then heated up to a more normal temperature?

Yes, 100%.

If so, to what temperature is the air then heated? ..... deg F.

60-65F, 20%; 66-75F, 80%.

5—If the air entering the show window spaces is not heated, what temperature is allowed to exist inside these spaces (outside temperature, inside temperature, etc.).
Inside, 25%; as near to outside as can be determined, 75%.

6—(a) If condensation occurs, is there any physical damage to displays, building, etc.?

No, 71%; yes, 29%.

(b) If damage does occur, approximately what percentage of the annual over-all maintenance expenses is used to repair this damage caused by moisture condensation on show windows?
Nil, 45%; $8 to $12 per window per year, 55%.

(c) If condensation is not allowed to occur (by dehumidification or other means), approximately what percentage of the annual over-all maintenance expenses is saved per year because of the preventative measures?
$6 to $8 per window per year, 82%; 4 to 6% of over-all maintenance costs, 18%.

7—(a) Is there any difficulty with show windows sweating in the warmer summer months?

No, 100%.

(b) If so, are the windows connected to an air conditioning system?

(c) If the window spaces are connected to an air conditioning system, what temperature is maintained in these spaces? ..... deg F.

8—If your store did not have show window displays, about what percentage of the total yearly volume of business would you expect to lose? (The idea of this question is to determine the value placed on show window displays.)
10 to 15%, 63%; 15 to 20%, 37%; 40%, 12%.
(this 40% value was placed by those which have new branch stores in localities and no "old" customers).

Methods of Preventing Condensation

The questionnaire revealed that the following three primary methods are now being employed to prevent moisture condensation on show windows:

(1) Sealing the window display area so that it acts as a still air space.*
(2) Use of air circulation in the display areas, with warm dry air entering the spaces in such a way as to be directed onto the glass surface.
(3) Dehumidifying the air in the display areas.

The most widely used method of preventing moisture condensation on show windows is the process of closing the display area tightly away from the rest of the store. In this way the enclosed air acts as a still air space and the only air which enters the space is the result of leakage through cracks. This method has proven to be quite successful as long as the air leakage from the store is very slight. However, the original construction of the window mounting and inside structure must be done carefully to minimize cracks for air infiltration; otherwise the air conditions inside the display area will reach the critical point for condensation to occur.

One store in Omaha, Neb., has used this method of closing the display for preventing moisture condensation on show windows for a number of years and encountered no trouble until the recent remodeling of one bank of windows. In the remodeling process it appears that not enough care was taken to tightly seal all points of possible air seepage from the inside of the store. As a result of this, great difficulty was encountered with frost appearing on the show windows during the winter months. Under these conditions the logical corrective method for the prevention of moisture condensation was to introduce air motion into the enclosed space and effectively increase the inside temperature of the window surface by increasing the value of the coefficient of heat transmission of the inside air film; the air motion would also tend to cause the condensed moisture to evaporate almost immediately after condensation. The air motion was introduced in these display areas by locating fans in such a way as to direct the air flow against the inside window surface.

Another of the predominant methods employed to prevent moisture condensation on the show windows is to direct incoming air, from the main heating plant, directly onto the windows. This method, of course, requires the use of auxiliary air ducts. If the air entering the store proper is to be humidified, as is often done in cold weather, the air which goes to the window

*Another method is shown in Fig. 6 and 7.

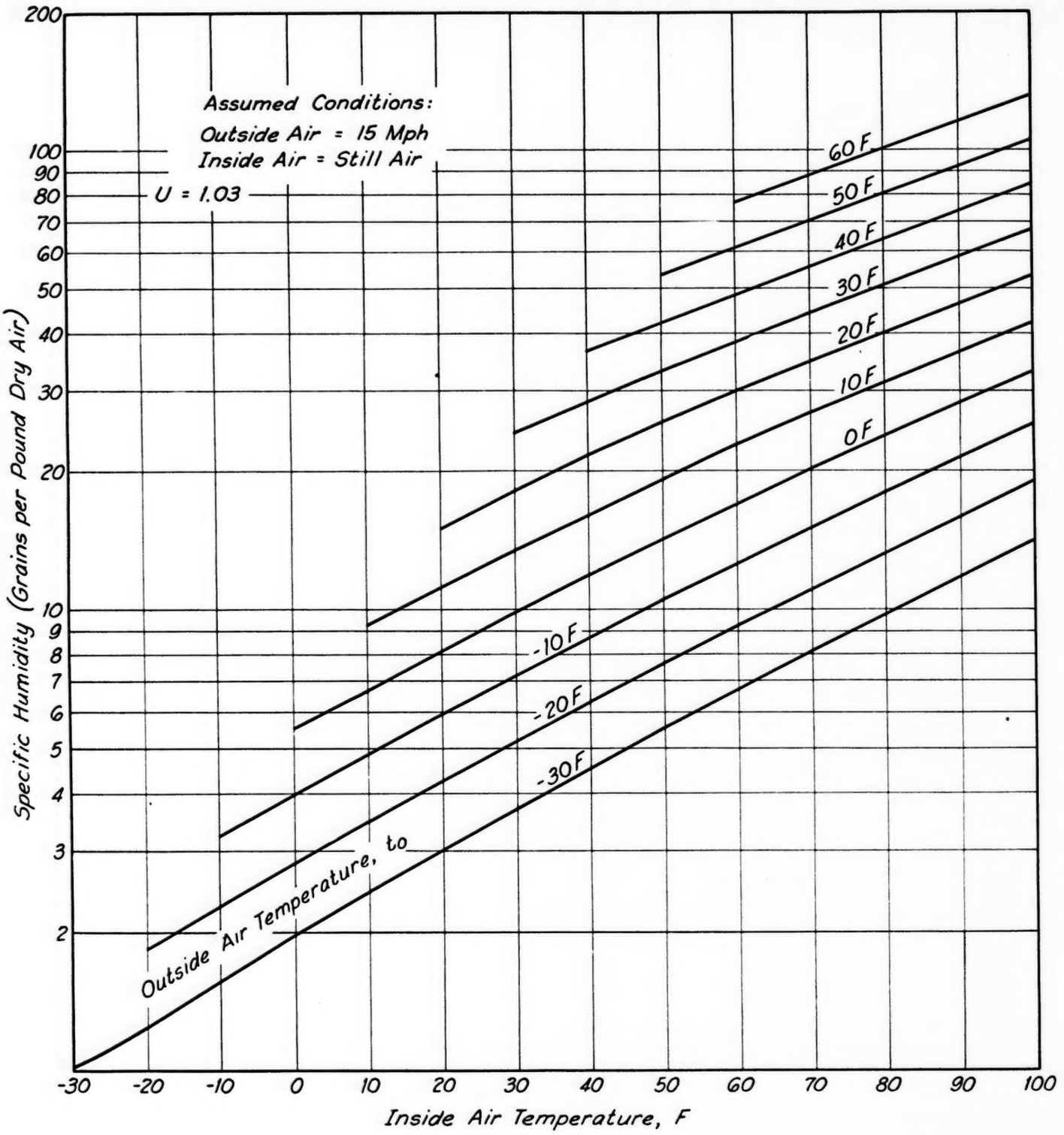


Fig. 5. Inside specific humidity at which condensation will occur for a given inside and outside temperature.

display areas must be of low enough relative humidity to keep from inducing moisture condensation rather than preventing it. This air entering the display areas is passed through air ducts above or below the window encasement where the air is allowed to escape directly onto the window surface. This method has proven very successful even in cases where fresh flower displays were used.

The reason for the success is threefold: (1) the air motion introduced in this manner is only local near the glass surface and is dissipated a short distance away from the surface and therefore will not disturb the displays; (2) the warm dry air which comes in contact with the windows is able to absorb any moisture which may tend to condense onto the surface before a visible film is developed; (3) the actual air which comes in contact with the window surface is the warmest air in the surroundings and thus the surface of the window is actually raised to a point where condensation is not likely to occur.

Sealing Display Area

One of the more frequent problems of moisture condensation arises when the method of prevention is that of sealing the window display area into a still air

space. The problem arises not when the window is being used to serve its normal function of presenting merchandise to the public, but rather when the display is being changed. At this time the entrance door must be open and the air exists as it is in the store proper. This air is usually of such characteristic that water droplets soon appear on the window surface. A solution is provided by employing portable fans to be used in the display area whenever the displays are being changed. Another corrective measure under these conditions is to have a draw curtain or retractable venetian blind in front of the window surface which thus prevents the warm humid air from coming in contact with the glass. An additional aid is to have a wing covering the entrance door which deflects the incoming air away from the windows.

Dehumidification of the air to a relative humidity below the critical value in the display areas of show windows is a method which apparently is not used very frequently. In cases where the display areas are not sealed tightly enough, and when these areas are connected to the air conditioning plant, dehumidifying the air appears to be a good, easy way of correcting the problem of moisture condensation or frosting on the window surface. At the present time the author knows of two types of dehumidification units which are relatively low in cost and take a minimum amount of space. One type unit uses silica gel as a dehumidifying agent and operates automatically on an adsorption cycle and a reactivating cycle. Another type unit works on the principle of a refrigeration coil, cooling the air to below the dew point and thus condensing out excess moisture.

The method of air dehumidification is of most importance in stores which have the air spaces of show windows connected to an air conditioning system. Since it is not practical to attempt to withdraw the circulated air from the heating unit before it enters the humidifier, if condensation on the windows is noticed, it would be necessary to shut off the water sprays in the humidifier to keep the relative humidity down below the critical value. This method, although the simplest under the circumstances, is undesirable since it requires constantly watching the windows and would also defeat the purpose of the air conditioning system. The alternative method of employing a small dehumidifier in the display area is by far the most practical, for it allows the air conditioning system to perform its primary function and still maintains the relative humidity in the critical localities below the condensation point.

Present and Proposed Corrective Methods

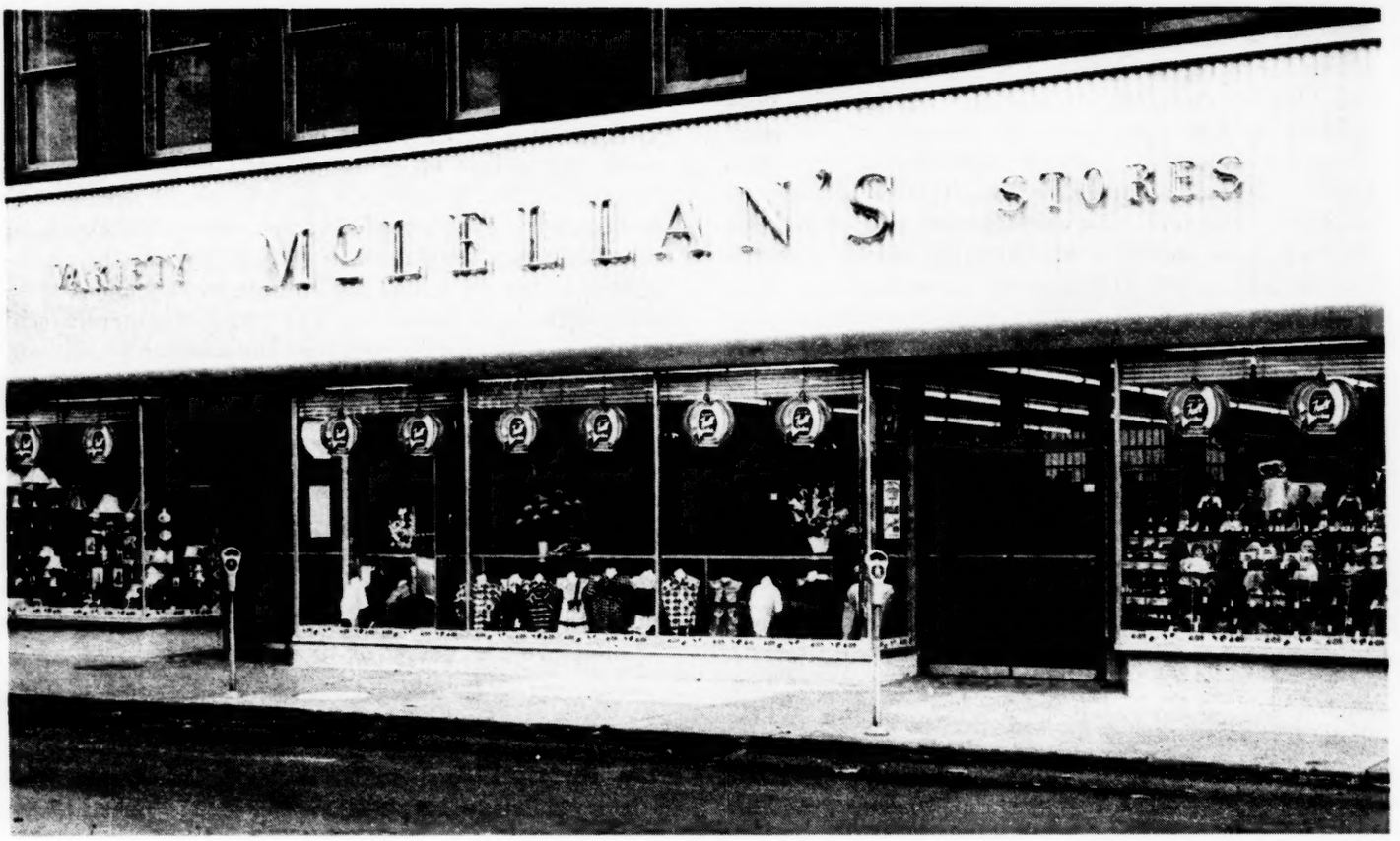
The process of sealing the display areas of show windows so that air leakage into the enclosure is held to a minimum is a method which can cause many difficulties. First of all, there is the possibility that the enclosure will not be as tightly sealed as is required. It is not the air seepage from the store which is detrimental to the problem, but rather the moisture which is a constituent of the incoming air. The amount of air which can infiltrate into the enclosure is actually very small in terms of the volume of air already there, but if the inside air temperature of the display area is very low, the amount of moisture which enters with the incoming air need be of only very minute quantities before condensation will appear on the window surface.

For example, suppose the air temperature in the enclosure using plate glass windows is 50F, with an outside temperature of —10F. Referring to Fig. 3, the allowable relative humidity is 20%, or the specific humidity, from Fig. 5, cannot exceed approximately 11 gr of moisture per pound of dry air. Now, further, suppose that the air inside the store is at 72F and a relative humidity of 35% (which is within the scope of the winter comfort zone), and that the amount of this air filtering into the 6 ft x 10 ft x 8 ft display area is on the order of 10 cu ft per hr. The number of grains of moisture which would also infiltrate would then be about 42 gr per pound of dry air or $\frac{\text{42 gr per lb dry air}}{\text{13.4 cu ft per lb dry air}} =$ 31 gr moisture infiltrating per hour. Since the 480 cu ft of enclosure can only carry a maximum of 11 gr of moisture per pound of dry air, or $\frac{\text{11 gr per lb dry air}}{\text{12.8 cu ft per lb dry air}} \times 480 \text{ cu ft} = 412$ gr moisture, the 31 gr moisture per hour which are moving in would require only 412/31 or 13.3 hours. Let us say it would require 14 hours to build the moisture content of the area to the critical point even if no moisture was present at the start.

Automatic Sprinkler Protection

Another important consideration which should be taken into account if the window display areas are sealed is that of the possible minimum temperature which might exist inside the enclosure under the most adverse conditions. It is quite possible that this still air space might reach a temperature below freezing if the outside air temperature should reach some extreme low. Since most modern stores employ automatic sprinkler systems for safety purposes, if the temperature in the display area were below freezing there would be danger of damaging the sprinkler units and creating a fire hazard unless a dry pipe system is used with the sprinklers. The other logical reason for not allowing the temperature to drop too low in these areas is that personnel must work in the area at certain times to change the window displays, and some degree of comfort should be maintained.

Since the temperature should not be allowed to drop too low in the sealed display areas, some means of heating should be incorporated. Lighting, which is a necessity in show windows, offers some degree of heating. However, this is usually not enough to take care of the required heating load under the most adverse conditions. For this reason, small radiant or convection heaters should be used, preferably located directly below the windows so that the heat may pass over the window surface and help prevent moisture condensation. As the temperature inside the display areas is raised, the allowable relative humidity decreases, but the allowable specific humidity increases. It is the specific humidity which is the actual controlling condition for the prevention of moisture condensation.



Courtesy, McLellan Stores Co.

Fig. 6. Small holes under the overhang of the windows permit the entrance of outside air near the windows. Air is discharged through the roof.

The use of warm air circulation as a means of preventing moisture condensation on show windows is probably the best method if the air entering the display areas is directed against the window glass. With this method not only is the temperature of the surrounding air maintained at a more normal level, but the window surface temperature is increased to a point where the critical relative humidity of the air is much higher than is indicated by Fig. 3. Even with the increased allowable relative humidity, difficulty may be encountered because of the incoming air having too high a moisture content due to the air conditioning plant.

If the heating system includes humidifying the air before it enters the display areas, care must be taken to shut off the water sprays in the humidifier if moisture condensation appears on the show windows. The more logical alternative to shutting off the sprays is the preventive measure of having a small dehumidifier located in the display area to withdraw excess moisture from the surrounding air. This small unit would also be useful if the displays included fresh flowers or perhaps a water fountain. In these latter cases, the moisture evaporated from the display will invariably cause condensation to take place if no precautions are observed.

Use of fans in windows has the disadvantage of being unsightly, and also a decided disadvantage in that the air motion caused by fans is usually too much to keep from disturbing displays in one way or another. Operation of small fans is very helpful as an emergency measure in cases where moisture condensation appears unexpectedly. However, as a permanent preventive measure, it is certainly not the best.

One plan for preventing moisture condensation on show windows which is not unthinkable is the idea of using a double glass instead of a single glass. This possibility is similar to the idea of using storm windows in residences during the winter months. To use a double glass window in a retail store, however, would necessitate the use of two windows mounted on one frame, such as Thermopane or Twindow, with a small air space between the panes. Such a window would, for all practical purposes, eliminate the problem of moisture condensation on the inside window surface, as the value of the over-all coefficient of heat transmission would be greatly reduced and the allowable relative humidity would be high under almost all possible conditions of inside and outside air temperature.

These double glass windows are not available in all sizes. For example, Thermopane, with two panes of plate glass and ½ inch air space between, can be obtained in sizes up to a maximum area of 9,600 sq in. The maximum total length can be 132 inches with 96 inches as the greatest width. If the window is 132 inches long, then the width can not exceed 9,600/132, or 72.5 inches.

It is important to note that the problem of moisture condensation on show windows is one that varies extensively from one climatic region to another. For example, the method of sealing the window display areas is one which will work very well in regions where the temperature does not drop excessively during the coldest months of the year, such as in Seattle,

Wash. This method may prove unsuccessful in localities where the outside temperature goes below zero continuously during the winter.

Before analyzing the cost of preventing moisture condensation on show windows under each of the different methods previously described, it would be wise to first understand the value which is placed on the displays which appear in the windows. The last question asked on the questionnaire was: "If your store did not have show window displays, about what percentage of the total yearly volume of business would the store expect to lose?" The replies to this question and to the question concerning annual maintenance expenses saved per year by preventing possible damage caused by moisture condensation indicate clearly the high value placed on show windows by the different stores. The replies to these questions would not be taken so seriously if they were not consistent, but the same answers appearing on many of the returned questionnaires indicates that the answers are reliable.

The over-all value placed on show windows in terms of a percentage of yearly volume of business was estimated at from 10 to 15%. As a percentage this does not mean too much, but when broken down into dollars and cents it can mean $100,000 for a store that has a gross business volume of $1,000,000 per year. Thus, on a dollars and cents basis, the prevention of moisture condensation on show windows means dollars in the pocket for the merchant. Similarly, the damage done to window moldings and floors by water dripping off the window when condensation occurs has been evaluated at approximately $10 per year per window, with a cost of maintenance set at $2 per year if the condensation is prevented from occurring. Again, the preventive measure means money in the merchant's pocket.

Along the same line, from remarks made on the returned questionnaires, it seems evident that show window displays will draw in four customers to every one attracted to the store by newspaper advertising. For these reasons it is evident that some expense is warranted to prevent moisture condensation from occurring on the show windows.

Probably the most inexpensive method of preventing moisture condensation is the process of sealing the enclosed display area from the rest of the store. The only cost in this process is that of labor and a small amount of material incurred during the construction period. In terms of the over-all building cost, this would be of negligible amounts. However, this method can only be used in certain localities where the minimum yearly temperature would not be much under 15F. If an attempt is made to seal the windows where the minimum temperature gets much below this, some allowance should be made to use portable fans under the more adverse conditions, and assurance should be had that no damage will occur to sprinkling systems if the temperature in the display area should drop below freezing.

The use of warm air circulation in the display areas to prevent condensation adds to the over-all heating load in the store and requires the use of air ducts and allied equipment. This cost would vary with each installation. However, it can be estimated that the average window and adjacent display area would require an additional investment of about $100 to cover the cost of ducts. If the warm air supplied to the windows is humidified, then a dehumidifier must be placed in the display area to bring down the moisture content of the delivered air. Either of the two usual types of junior size dehumidifiers sells for about $150. Depending upon the size of the window enclosures, it is possible for a dehumidifier unit to serve one or more show windows.

The idea of using double glass windows is probably the most expensive of all the methods, from the standpoint of initial investment. A recent check with plate glass dealers indicates that a window made of single plate glass would cost about $1.25 per sq ft for sizes required under the circumstances and a cost of about $3.75 per sq ft for similar sizes of double glass windows. In the sizes normally employed for show windows, this would mean a comparative cost of about $125 for the single glass as compared to $375 for the double glass. While this additional cost appears favorable when noting the added investment required for the previous method of prevention, the insurance rates on the double windows must be taken into account. The insurance for a single glass show window runs on the order of $10 per year, whereas for a double window the rate is $40 per year. The reason for this is that the insurance companies consider that both double windows must be replaced even though only one of the two glasses should be broken.

Shown below is a comparison of the first costs and the operating costs for the three possible methods of checking condensation for an average installation.

Initial Cost

1. $100 for ducts plus $125 for window glass ... $225
2. $150 for dehumidifier unit plus $125 for window glass ... 275
3. Cost of double window glass ... 375

Operating Costs

1. Cost of furnishing heat to balance heat lost through single plate glass of 100 sq ft area plus $10 insurance on window.
2. Cost of operating dehumidifier plus $10 insurance on window.
3. Insurance for double window, $40.

If the heat or dehumidifying costs for (1) or (2) are $30 per year or more, then $30 plus the insurance costs equal, or are greater than that for a double glass window. In some cases, the economics may favor single glass windows, and in others, the double glass windows.

This study indicated that each particular design must be carefully examined, and all factors considered, before one can arrive at a final decision as to which of the three systems considered will prove the most economical.

Summary

The prevention of moisture condensation on show windows is of utmost monetary importance to the

Courtesy, McLellan Stores Co.

Fig. 7. Each window of this St. Paul, Minn., store has a grille leading to a plenum chamber, below the window, which supplies outside air through a slotted opening near the window bottom. A duct from each window leads to common roof outlet.

merchant, both from the standpoint of increased business and savings in annual maintenance expenditures. Depending on the climatic conditions in the locality, the prevention may require very little additional expense as in the case of sealing the windows, or it may require the use of additional equipment at an additional expense of about $250 per window, as in the case where warm air circulation is required along with a dehumidifying unit. The possibility of using double glass windows is not feasible unless extremely low winter temperatures are encountered, because an additional investment of about $250 per window plus an added annual insurance premium of $30 per window is required.

Three main methods of preventing moisture condensation on the show windows are:

(1) Completely sealing the show window spaces.
(2) Using warm air circulation in the window spaces.
(3) Using a small dehumidifier in the window display area.

The method of sealing the display area from the surroundings is one which is economical and effective in climates where the minimum winter temperature does not drop much below 15F. If the temperature does go much below this minimum, then some means of auxiliary heating should be employed to prevent not only moisture condensation, but also to avoid the possibility of the sprinkler system freezing, in the event the display area should have a temperature that is below 32F.

Where the minimum winter temperature is much below zero, it is advisable to incorporate a means of using circulated air in display spaces, the air coming from the main heating plant of the store. This method requires an additional investment of about $250, if the store uses an air conditioning plant, since it would probably be necessary to use a small dehumidifier in the display area for extracting any excess moisture from the air.

Where the windows have been sealed, it is often necessary to use precautionary measures at the times when the window displays are being changed, otherwise the air entering from the store at these times may cause the windows to fog over.

Bibliography

American Society of Heating & Ventilating Engineers, *Heating, Ventilating, and Air Conditioning Guide*, Vol. 27, 1949, pp. 115-148.

Faires, Virgil M., *Applied Thermodynamics*, Macmillan Co., 1947, pp. 395-419.

Feller, Eugene W. F., *Instrument and Control Manual for Operating Engineers*, McGraw-Hill Book Co., 1947, pp. 185-192.

Fernald, E. M., *Elements of Thermodynamics*, McGraw-Hill Book Co., 1938, pp. 153-173.

Harding, L. A. and Willard, A. C., *Mechanical Equipment of Buildings*, John Wiley & Sons, 1929, 2nd Ed., Vol. I, pp. 741-816.

Jennings, B. H. and Lewis, S. R., *Air Conditioning and Refrigeration*, International Textbook Co., 1944, pp. 31-63.

Jordon, R. C. and Priester, G. B., *Refrigeration and Air Conditioning*, Prentice-Hall, Inc., 1949, pp. 149-235, 337-359.

Severns, W. H., *Heating, Ventilating and Air Conditioning Fundamentals*, John Wiley & Sons, 1937, pp. 38-70, 72-86, 314-328, 381-401, 404-418.

Shoop, C. F. and Tuve, G. L., *Mechanical Engineering Practice*, McGraw-Hill Book Co., 1949, pp. 410-418 431-440.

NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite Page 102 for securing additional information on items described in this department.

Device Stops Sprinkler Flow

A new device to stop property damage by water from sprinklers after a fire has been extinguished or in case of mechanical failure has been put on the market by Sprinkler Stopper Co., Englewood, N. J. This stopper is a simple unit which fits on the end of a short pole and is easily inserted in the ring of the sprinkler to shut off the water at the point of flow.

Device is essentially a wedge with a three-layer rubber diaphragm which covers the outlet, pressure being maintained by a mechanical spring incorporated in the assembly. The sprinkler stopper is put in place by firemen who respond to an alarm or by other personnel.

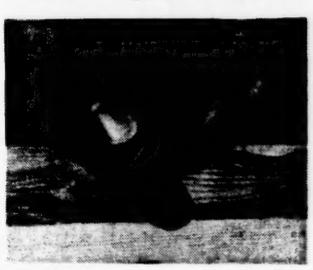
This stopper makes it possible to shut off the water in an area where the fire has been extinguished without interfering with the flow in other areas where it may still be needed. Furthermore, the fact that the device is attached to a pole makes it easy to remove. The water may be made to flow again in seconds. The dangling pole also serves notice that the sprinkler is temporarily out of operation.

Ninety percent of sprinkler alarms to which fire departments respond are one-head operations. Some of these alarms have not even been produced by fire but by mechanical damage. Most of the fires which start in a sprinklered building are put out by one sprinkler before the other sprinklers are affected.

For more information, circle on Inquiry Card, **Item 1**

Staples for Copper Tubing

A line of Tube-Tite staples is being made by E. H. Titchener & Co., Binghamton, N. Y., to fasten copper and brass tubing used in radiant heating, hot and cold water service lines, refrigeration lines, and similar installations.



The staples are made in three sizes from pure copper, with a steel core for strength. The three sizes are designed to fit ⅜, ½ or ¾ inch nominal tubing (actual O.D. ½, ⅝ or ⅞ inch). For the first two tubing sizes a flat top staple made from flat stock has been designed. For the ⅞ inch O.D. size a round wire staple with a round top is included in the line.

Tube-Tite staples answer the need for a fastener which is quick and easy to install, low in price, and immediately available. The solid copper surface of the staples insures against any galvanic action between staple and the copper or brass tubing. They are packaged attractively and conveniently in cartons of 100 or 500 pieces.

For more information, circle on Inquiry Card, **Item 2**

Trap Cleans Compressed Air

A complete line of separators for cleaning compressed air by means of centrifugal force is announced by The Swartwout Co., Cleveland, Ohio. Known as the Airfuge, the separator is available in seven inlet and outlet tapping sizes, from ½ to 2½ inches.

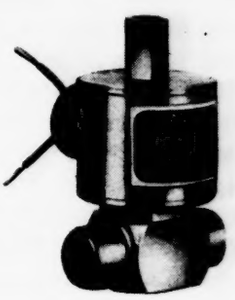
According to the manufacturer, this device removes 99% or more of all impurities from compressed air without pressure drop. Moisture, oil, scale and other solids in the air are whirled outward to the walls of the unit where they drain down to the trap section. At the same time the clean, dry air passes unimpeded to feed line or tool, operating the equipment without danger of corrosion, wear, clogging, fire, explosion or freezing, which occur with contaminated air.

A float-operated trap automatically releases accumulated liquids as they rise to a level above that necessary to effect a seal. Drain valve outlet is tapered to prevent stoppage by particles of scale, etc.

For more information, circle on Inquiry Card, **Item 3**

2- and 3-Way Solenoid Valves

Two important additions to its extensive line of Asco two-way and three-way packless solenoid valves is announced by Automatic Switch Co., Orange, N. J. Because of their extremely small size, both pipe and over-all, they are named Midget valves. The two-way valve could fit comfortably within a 2¾ inch cube; the three-way valve within a 3½ inch cube.

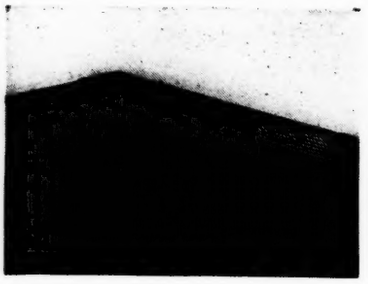


These valves are designed to take care of very severe and frequent service. They handle a wide range of liquids and gases at temperatures up to 212 deg. They are particularly suited for assembly in equipment where a compact, efficient and durable automatic control is needed, such as with oil burners, dispensers, measuring and testing apparatus, gas heaters and diaphragm motor controls.

For more information, circle on Inquiry Card, **Item 4**

Electric Baseboard Panels

The Electriglas radiant heat baseboard panel has been introduced by Appleman Glass Works, Bergenfield, N. J., for prime or supplemental electric heating of homes, offices, hotels, schools and other applications. It consists of a glass panel encased in a steel frame. Designed to take the place of the ordinary baseboard in a house, it is usually surface mounted in old construction and recess mounted in new construction. The panel contains a chemical element which is fused into the back surface of the glass.



Surface temperature of the glass reaches approximately 240 deg. Fully automatic in operation, the baseboard panels are used with a separate low voltage thermostat and relay.

The baseboard panels are available in two sizes, a 300 watt (1024 Btu) unit 42 inches long, and a 200 watt unit (683 Btu) 30 inches long. Both are 6½ inches in height and 1¼ inches deep. The sections are held together by ½ inch conduit nipples, lock-nuts and bushings. A junction cover plate is used to cover the terminal block and glass mounting brackets. There are left-hand closing and right-hand closing pieces for use at terminations.

For more information, circle on Inquiry Card, **Item 5**

Portable Electric Welder

New engineering developments in arc welding equipment are evident in the new portable electric arc welder, Model 125A, announced by Trindl Products, Ltd., Chicago, Ill. Compact in design and completely portable for on-the-spot welding, the new welder welds light as well as heavy gage metals and is ideal for all types of installation, construction and maintenance work.

Features in design introduced include: Improved method of cooling; sloping control panel for ease of operation; simplified terminal control; ease of striking arc; solderless connectors throughout; spun glass insulated transformer; fully insulated terminals.

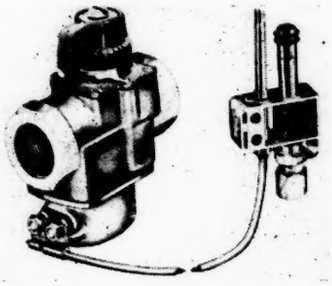
Operating features are: Positive control; staple arc; no arc blow; no moving parts to wear out; low initial cost; low operating cost; greater ease of operation; and compact design increases the portability.

The new model has 16 heat stages ranging from 20 to 125 amps. It handles from 1/16 to 5/32 inch welding rod and welds iron, steel, brass, bronze and other metals in a wide range of gages.

For more information, circle on Inquiry Card, **Item 6**

Gas Safety and Pilot Burner

Two new products, the MR-5, ¾ inch gas cock safety valve (left) and the 260 series pilot burner (right), are announced by General Controls Co., Glendale, Calif. Designed with price in mind, the new products are precision-made to accommodate the requirements of adequate heating control, while providing means for safety and low fuel consumption.



The pilot burner is designed on a smaller scale than its predecessors. It incorporates a removable filter screen that assists in eliminating the nuisance of lint plugging. The special mounting bracket, designed for various types of appliance installation, holds both the burner and the thermocouple in secure operating relation to each other.

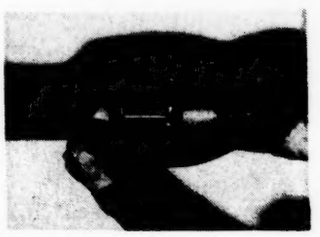
The safety valve includes the essential 100% safety shut-off feature, in the event of pilot flame failure. The plastic manual reset handle may be removed to expose a rod-fitting device for use with floor furnace installations.

For more information, circle on Inquiry Card, **Item 7**

Zipper Coats Protect Joints

A line of Zipcoats for protecting coupled pipe joints, welding joints and insulating joints from corrosion is announced by Dresser Mfg. Division, Dresser Industries, Inc., Bradford, Pa.

The Zipcoat for couplings is designed to cover and protect a Dresser coupled joint and has a bleeder valve to vent air during backfilling. The coat for welded joints is for the protection of a circumferentially welded joint, while that for insulating joints is similar to the coat for welded joints but comes in 10-foot lengths. It eliminates costly boxing and permits immediate trench back-filling.



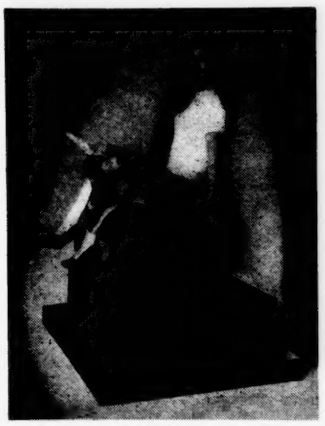
The coats are said to be easy to install, the time required for installation being only a tenth of the time it takes to coat a joint. At the same time, they eliminate definite hazards: No working with flames; no handling of hot coating compounds; no danger from fumes or burns. The coats have high dielectric strength and give protection that equals or exceeds that of mill or yard-wrapped pipe. Each contains an anaerobic microbiological corrosion inhibitor.

After being applied and folded over at the end, a cold sealing compound is applied over the joints and ends.

For more information, circle on Inquiry Card, **Item 8**

New Power Exhauster Added

The Airmax power exhauster is now in production by The Gallaher Co., Omaha, Neb., and Owatonna, Minn. The new unit in no way replaces the present Gallaher Air-Van power exhauster but supplements the line for applications where the chief aim is the movement of maximum amounts of dry uncontaminated air at minimum horsepower.



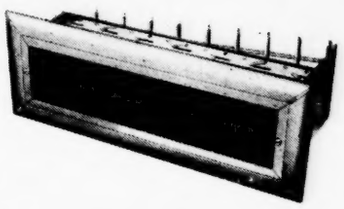
Unit incorporates latest design features, including modern low silhouette. Maximum height for the largest unit is 36½ inches. It is fully blackout in line with defense requirements. Air expulsion is downward on to roof through weatherproof outlet; where upward discharge is desired, the unit can be supplied without mushroom cover.

For convenience the unit is shipped as a complete package ready for installation. Fan embodies latest developments in air-foil design. Blades are high tensile strength, four or six blade aluminum alloy, balanced and designed so that they can be replaced in the field without purchase of an entire new wheel. Blades are also vinylite coated for resistance to acid and alkali fumes. Catalog available.

For more information, circle on Inquiry Card, **Item 9**

Grille Cuts Installing Costs

For reduced sheet metal erection and fabrication costs, duct take-offs can be eliminated with the type MA combined grille, volume control and deflecting vane introduced by Barber-Colman Co., Rockford, Ill. Installation costs are also reduced by installation of three units in a single operation.



Engineered air deflecting vanes produce uniform flow across the grille face and minimize duct turbulence and turning losses. For ease in system balance, volume control adjuster is accessible from the grille face, yet hidden and tamper-proof. Supply air deflection can be conveniently adjusted vertically or horizontally after installation. Diffusing lugs on the grille fins promote thorough mixing of room and supply air for elimination of drafts and rapid temperature equalization.

For more information, circle on Inquiry Card, **Item 10**

Large Size Water Softeners

The larger type water softeners for commercial and industrial use are largely sold direct to the user, according to the Bruner Corp., Milwaukee, Wis. Consequently, this company feels that its plan of placing its Supreme water softeners on a mass production basis, making it possible to offer these units at a competitive price so that the plumbing contractor can compete with direct sales, will be of interest to plumbers.

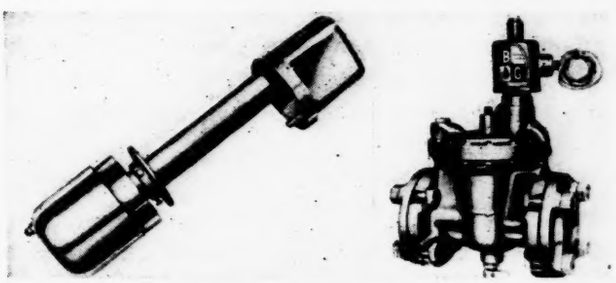
The new commercial units are available in seven sizes from 125,000 grain capacity to 600,000 grain capacity for single units and 1,200,000 grain capacity for twin units. Included in the new line are the semi-automatic model with solo valve regeneration control and the completely automatic patented Supreme line, now available in commercial as well as domestic sizes, and constructed with up to 2 inch piping. The company claims it is the first manufacturer to put out a complete commercial line on a production basis which can be sold at a profit by plumbing contractors.

For more information, circle on Inquiry Card, **Item 11**

Hot Water Control System

The B & G Comfort Control for hot water heating systems, which anticipates changes in outdoor temperature and wind velocity before they are reflected in the indoor temperature, is introduced by Bell & Gossett Co., Morton Grove, Ill.

Entirely mechanical in operation, and containing no bellows or capillary tubes, the regulator can be adapted to any forced hot water system. It consists of two units, the control regulator (left view) and the control valve (right). The right-hand portion of the regulator extends through the building wall, exposed to wind and weather, while a flow of system hot water circulates through the indoor end. A small part of the heat from



the circuit is conducted through the regulator to the outdoor end where the heat is dissipated at a rate depending on the outdoor temperature and wind velocity.

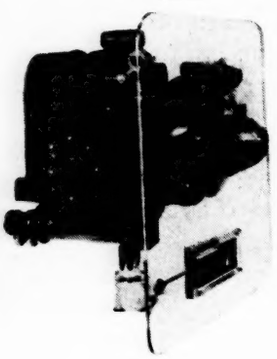
Dissipation of this heat through the regulator determines the operation of the Comfort Control valve which allows heat to flow to the radiation circuit in the amount required to compensate for the heat losses of the building. The result is an even and comfortable indoor temperature balanced with the outdoor weather.

In large buildings where heating requirements differ due to exposure or changes in the type of heating elements, the building may be divided into separate zones, each with its own Comfort Control system. In a one-zone system, the regulator is best located on the north wall. The regulator can also be used to control a zone subject to solar heat. In this case it should be installed in the south wall.

For more information, circle on Inquiry Card, **Item 12**

Industrial Oil Burners, 9 to 60 GPH

A new industrial oil burner of the horizontal, rotary atomizing type to burn No. 6 oil or lighter is announced in six sizes by Iron Fireman Mfg. Co., Cleveland, Ohio. These are available in nominal ratings of 9, 16, 25, 35, 50 and 60 gallons per hour and are equipped with the company's Oil Volumeter which allows use of grades of oil up to No. 6 of varying viscosities without change of adjustment. They may be used for all types of high or low pressure boilers and for many industrial applications.



This burner has a gear-type circulating pump, which runs at low speed, maintaining a constant supply of oil in the reservoir. The reservoir provides a head of oil at all times over the metering pump which is submerged in the reservoir. Any air drawn into the line is automatically vented from the top of the reservoir thus keeping the oil, in which the metering pump is submerged, always free of air.

The burners may have either manual or automatic control and ignition. Ignition may be either gas-electric or light oil-electric.

Unit is powered by a V-belt drive and standard 1,750 rpm motor. It has a noncarbonizing flame shaper which allows the flame to be adjusted to the proportions of the combustion chamber. Vanes controlling the flame shape are situated well back of the oil nozzle to prevent fouling by carbon deposits.

For more information, circle on Inquiry Card, **Item 13**

Back Siphon Preventer

A new and improved vacuum breaker or back siphon preventer has been announced by Speakman Co., Wilmington, Del. All working parts are easily and quickly replaceable.

The back-siphon preventer is simplified in construction. It consists of three parts: body, water valve, and washer. Body is brass and measures 3 inches in height and is chrome plated on all exterior surfaces. It fits all types of the company's flush valves and is designed to be assembled below the body of the flush valve. It is furnished with 1½ inch O.D. slip outlet. It can also be obtained for ¾ or 1¼ inch O.D. flush connection.

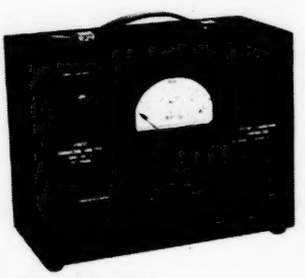
Water valve is brass and can be removed by lifting from the body for quick repair or replacement.

These valves are available normally closed (close when de-energized) and normally open (open when de-energized). Three-way valves (illustrated) are of the universal type, being applicable to any three-way requirement regardless of the direction of flow or points of pressure application. The standard valve without any change of springs or other adjustments is suitable for any three-way control application. Pipe sizes of two-way valves are ⅛ and ¼ inch, normally closed, and ⅛ inch, normally open. Permissible pressures range up to 300 lb per sq in. for AC and up to 250 lb per sq in. for DC. Adjustable Main Flow and Adjustable By-Pass attachments available. Pipe size of the three-way valve is ⅛ inch only.

For more information, circle on Inquiry Card, **Item 14**

Combustion Tester, All Fuels

A complete combustion tester instrument, the Veco, has been introduced by Victory Engineering Corp., Newark, N. J. Instrument measures the three most important factors in the operation of a boiler or furnace with any fuel—the carbon dioxide content of the flue gas, the temperature of the flue gas and the draft over the fire. All readings are given on the same dial.



A single sampling tube is used for all readings in that it is combined with a built-in thermocouple which measures the flue gas temperature at the same point that the CO_2 measurement is being taken.

The instrument is powered by a 6-volt dry battery, mounted in a cabinet, and the instrument comes complete with battery, 8 feet of hose, gas sampling tube with thermocouple, filter-drier, hand aspirator, 8 feet of thermocouple cord and a bag. Manufacturer claims that it can be operated by anyone with limited experience.

For more information, circle on Inquiry Card, **Item 15**

−30 to +120 Deg. Thermometer

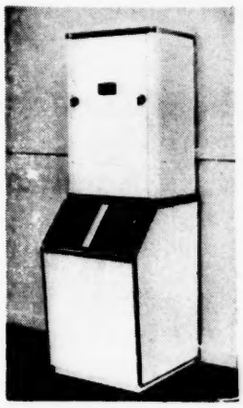
Convenience is the outstanding feature of the Thermicator, a pocket-type thermometer introduced by the Tagliabue Instruments Div., Weston Electrical Instrument Corp., Newark, N. J. Design is simplified and improved in this instrument, which can be used either as an armored or as a plain thermometer for temperatures between minus 30 deg and plus 120 deg.

The Thermicator consists of an etched-stem glass thermometer, slimmer than most fountain pens, and is held securely in coat, shirt or vest pocket of any depth by an adjustable clip. The metal case, which is open at both ends, has no separable cap to unscrew. Instead, the pinch-top of the thermometer projects slightly from the case; the thermometer itself is quickly whisked free or replaced in a single motion.

For more information, circle on Inquiry Card, **Item 16**

Cube or Crushed Ice Maker

An improved automatic ice maker, which will deliver either cubes or selected grades of crushed ice, is announced by Carrier Corporation, Syracuse, N. Y. Important among new features is the rearrangement and redesign of operating parts to facilitate cleaning and maintenance from the front of the unit. Use of a motor with a low starting current requirement permits direct hook-up with virtually all standard 115-volt electrical systems.



The factory installed ice cube crusher, an optional feature, provides a major degree of versatility. With a simple turn of a knob, the machine can be shifted from delivery of ice cubes to crushed ice. The grade of crushed ice can be controlled through a number of sizes from coarse to fine, by turning another knob.

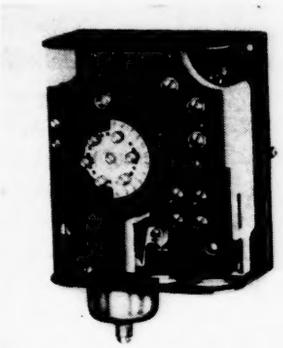
Operation of the ice cube maker is completely automatic and virtually noiseless. An ingenious freezing arrangement forms the cubes individually, 208 at a time, one above another with a space separating each one from the next, in rows of stainless steel tubes. This spacing of cubes prevents them from freezing together into solid columns of ice, and thus eliminates the noisy operation of chopping them apart.

Capacity of the machine is rated at up to 450 pounds of ice a day, or approximately 8,500 cubes. Its floor space requirement is small, 24 by 25 inches with a bin storing 160 pounds of ice, and 34 by 25 inches with the 240 pound bin.

For more information, circle on Inquiry Card, **Item 17**

Defrosting Control

A completely automatic control for defrosting evaporators on pre-packaged meat cases, reach-in boxes, and similar applications in the 24 to 35F band and higher, is available from Penn Electric Switch Co., Goshen, Ind.



The new control, designated as the Type 325 time-pressure or T-P defroster, shuts down the refrigeration compressor at preselected time intervals by means of a synchronous self-starting timer motor. The compressor is started again by rising back pressure at a point corresponding with a completely defrosted condition of the evaporator coils.

Length of defrost period is not dependent upon the timer, but is terminated when the coils are free from frost; thus the off period is completely self-adjusted. The defrost period time is varied automatically with load conditions and no seasonal adjustments are necessary.

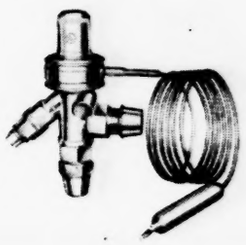
Unit incorporates a 24-hour dial and may be set to defrost from 1 to 8 times each 24-hour period. It is a dual voltage control.

For more information, circle on Inquiry Card, **Item 18**

Universal Expansion Valve

A new type of thermostatic expansion valve has been announced by A-P Controls Corp. (formerly Automatic Products Co.), Milwaukee, Wis. Known as the Model 209, the new valve has four features, which make it unique in design and practically universal in application.

Valve has an adjustable pressure-limit setting, with a range of from 0 to 55 lb. per sq in., which adapts it for use on any application where overload protection is desired. Setting is done with a clearly marked adjusting knob. The new design also provides a simple superheat adjustment to cover the entire normal operating range. In use, both adjustments are covered by moisture-tight and tamper-proof caps.



An advantage of the new valve is the liquid charge, which is a basic feature of all of the company's thermostatic expansion valves. This permits the valve to be used in any ambient temperature and in any position required by the installation. This liquid charge allows the valve to be used for any application, low, commercial or air conditioning, without change.

For more information, circle on Inquiry Card, **Item 19**

Line of Gas Unit Heaters

A complete line of blower and duct type gas-fired heaters has been announced by United States Air Conditioning Corp., Minneapolis, Minn.

Two features of heaters are said to assure long life and efficiency. The burner is arranged so the flame burns inside the heat exchanger. Thus, secondary air passes into the exchanger around the flame and shields the sides of the exchanger from its heat. Second, internal fins inside the heat exchanger at the top increase the heat transfer efficiency, of the upper part receiving the cooler gas, to such a degree that the air passing by it is heated to virtually the same temperature as the air at the bottom.

Design of the draft hood allows efficient combustion of the gas under all chimney conditions of updraft and downdraft. The heater is not affected by severe downdrafts, thus obviating hazards of fire and monoxide. Important parts of the heater are composed of stainless steel. The heaters are available in propeller, blower or duct types, with ratings ranging from 55,000 to 200,000 Btu per hr.

For more information, circle on Inquiry Card, **Item 20**

Low Cost Heat Exchanger

A new design heat exchanger, the Econalloy, is announced by the Martin-Quaid Co., Philadelphia 32, Pa., to provide corrosion resistance at a low cost.

In the new design, corrosion resistant materials are used only where required: as flange inserts and for the inner tube which contacts the fluid or vapor being heated. An important feature is that a corrosion resistant joint is made without welding to the inner tube. The alloy inner tube is expanded into prepared serrations in the inside diameter of the insert flange by special torque limit tools which prevent undesirable stresses. A positive joint is formed without the application of heat which would change the grain structure of the alloy and lower corrosion resistance.

The heat exchanger also provides uniform heat over the full surface from flange to flange without dead spots. It saves space because it forms an integral part of the piping system. It can be supported vertically or horizontally along a wall, or on hangers. Used singly or in groups, these heat exchangers are easily demounted for cleaning, and it is a simple matter to add additional capacity as needed.

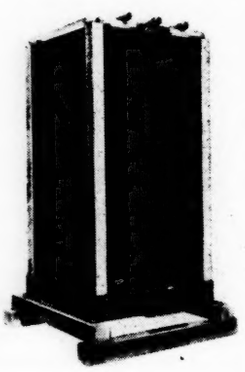
The line is furnished in sizes from a fraction of a square foot of heating surface to several hundred square feet in lengths up to 30 ft per segment. Internal tube size range from ¼ to 4 inches. Standard units are available for pressures up to 900 lb per sq inch, and temperature in excess of 700 deg.

For more information, circle on Inquiry Card, **Item 21**

3 to 35 Ton Cooling Towers

A new small capacity cooling tower featuring several advances in design has been added to the line of towers manufactured by Binks Mfg. Co., Chicago, Ill. The new tower is known as Type H.

This tower is an atmospheric spray cooling type for use with small packaged water-cooled air conditioning and refrigeration condensing units, and related applications. The towers are mass produced in 10 frame sizes with refrigeration loads ranging from 3 to 35 tons.

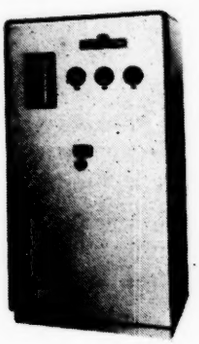


Among the new features are: pan is made with external bolting flanges for convenient and firm anchoring of the tower, eliminating piercing the floor of the water basin. Assembly of the tower is simplified. Newly designed corner posts bolt easily and rigidly to the pan sides. Slip-fit louvers, redwood or galvanized steel, as desired, slide into place through machine-slotted corner posts of new design which guarantee accurate spacing and angle. The float box is an integral part of the basin, and is mounted externally for easy access to the control valve.

For more information, circle on Inquiry Card, **Item 22**

High Capacity Chlorinator

The control of slime in cooling water systems, and the disinfection of water for industrial water supplies is made easier by the HCVS high capacity Chlorinizer announced by Builders-Providence, Inc., Providence, R. I. The unit has a visible flow feature and automatic control to provide chlorine to three points of application.



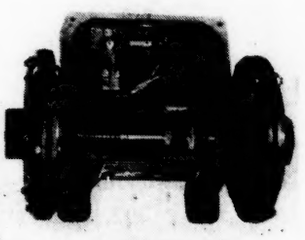
This control gives the proper feed rate to meet chlorine demand at three individual points and it will select the sequence of point of application. Chlorine dosage at any point of application is properly controlled and metered for any predetermined period at a suitable pre-selected rate.

The Chlorinizer is a simplified apparatus for metering and controlling chlorine gas feed by manual, semi-automatic, or automatic proportional means.

For more information, circle on Inquiry Card, **Item 23**

Differential Pressure Control

The Cat. 111-D differential pressure or vacuum control is an addition to its series of sensitive static pressure controls, made by Coral Designs Div., the Henry G. Dietz Co., Long Island City, N. Y. It is designed for use on very low differential pressure where regulation is required in inches of water, either pressure or vacuum, and where a leak path between diaphragm and atmosphere cannot be tolerated. It was developed to be airtight on both vacuum and pressure side of diaphragm. No leak is possible, since no seal of any kind is required.



This control has numerous applications where it is necessary to regulate the pressure between two vessels, and where no leak path can be tolerated.

Units are of small physical size, obtainable in standard ratings ranging from 0 to 20 inches of water pressure or vacuum with a range adjustment and with fixed differentials from 0.2 to 2 inches of water.

For more information, circle on Inquiry Card, **Item 24**

Electric Mat Heats Workers

Localized warming of chilly working areas is accomplished simply by application of the Dura-Thermal mat made by Walter B. Snook Enterprises, Palo Alto, Calif. Combining the features of a wire-coil doormat with a large-area electric element, the heater offers an inexpensive solution to loss of efficiency among uncomfortable workers.

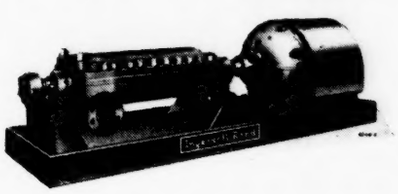
Coils of hard steel wire are wound over a 280-watt, 120-volt metal-encased element, distributed over the 16 x 27 inch mat area in a pattern assuring even, over-all heating. The whole is enclosed in a heavy frame with protective rails of tubular burnished aluminum. This construction is particularly adaptable for underfoot application, since the heated element is held away from the floor and will not even discolor painted surfaces. Also, as the user's feet are supported an equal distance above, free air circulation is maintained.

Electrical service connection is made through a 3-conductor heavy-duty rubber cable which provides a safe ground. The connection at the mat is waterproofed to enable using the unit on wet floors. In use as a floor mat, about 15% of the output is radiant and the balance convective heat. Due to the design and construction, however, the mat is effective in vertical wall or free-hanging applications as well. Price will be standardized at $21.50.

For more information, circle on Inquiry Card, **Item 25**

High Pressure Centrifugal Pump

A line of new multi-stage centrifugal pumps for high-pressure applications to 1200 lb per sq in. and capacities to 1,600 gpm, is announced by Ingersoll-Rand Co., Phillipsburg, N. J. Known as the Class HMTA, they are built in 3-, 4-, 5- and 6-inch sizes with from 3 to 9 stages. Applications cover a wide range of boiler-feed, pipeline pumping, and refinery as well as other general high-pressure industrial services where the temperatures are not over 650 deg.



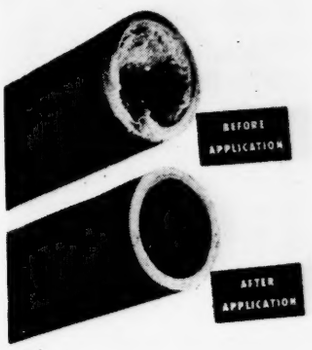
Features are its cylindrical-bore, horizontally-split casing and compact, Unit-Type rotor assembly. The rotor assembly is composed of the shaft, impellers, and channel rings. These channel ring sections contain the multiple volutes and fluid passages, as well as the renewable wearing parts for each stage. The entire rotor assembly is quickly and easily removed from and installed in the smooth-bore casing, since there are no mating ring fits or delicate alignment problems.

The pressure differential between successive stages in the pump is sealed by corrosion-resistant cast-iron or alloy-steel piston rings around the outer diameter of the channel rings. These hydraulic-type, step-seal rings have a metal-to-metal fit with the casing. A completely balanced rotor is assured with multiple-volute design, which eliminates radial thrust at all conditions of operation. Axial thrust, developed by in-line staging of the single-suction impellers, is effectively counteracted by a hydraulic balancing drum. The drum forms the only high-pressure breakdown in the pump and is accessible through the discharge stuffing box extension. By-pass piping to the suction from the balancing drum assembly places the discharge stuffing box under suction pressure. Ball or sleeve bearings may be provided on these pumps, as desired.

For more information, circle on Inquiry Card, **Item 26**

Boiler Water Treatment

Development of a new and stronger boiler water treatment, Warren Luminite, is announced by the Surface Coating Division, The Warren Refining & Chemical Co., Cleveland, Ohio. Because of its powerful action, boiler water can now be treated with this product for approximately half of the former cost, the maker claims.

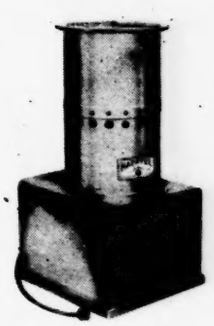


The treatment is a coagulant which combines the advantages of chemical and colloidal methods in a simple, effective and guaranteed system. It is specifically designed for removal and prevention of scale formation, elimination of pitting, congestion, rust, corrosion, foaming and priming in steam boilers. Because no two boiler installations are exactly alike, the treatment is formulated to the customer's specifications, after an inspection and survey of operating conditions.

For more information, circle on Inquiry Card, **Item 27**

Junior Size Dehumidifier

A junior commercial and industrial dehumidifier, No. 50, is announced by Walter Haertel Co., Minneapolis, Minn. Powered with a ½ hp hermetically sealed Freon condensing unit, it has a capacity of 50 pounds of water removal from the air per 24 hours.



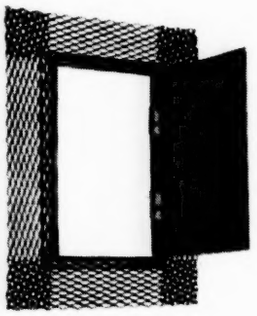
Due to improvements in design, the machine will remove 1 gallon of water from the air in storerooms or other closed spaces in from four to five hours, under average temperature and relative humidity conditions.

Optional automatic means of disposing of the condensate removed from the air, makes it unnecessary to carry a pail.

For more information, circle on Inquiry Card, **Item 28**

Steel Access Doors Improved

Improvements in its line of steel access doors have been announced by Inland Steel Products Co., Milwaukee, Wis. No-sag spring hinges allow the door to be opened to 175° and position the door positively for a better fit and easier closing. By extracting the pins from the hinges, the door can be completely removed from the frame. A rust-inhibitive gray paint is used as a primer coat. Individual packaging of the doors has been adopted, with one door packed in a sturdy carton and the contents clearly identified by a bright, easily read label.



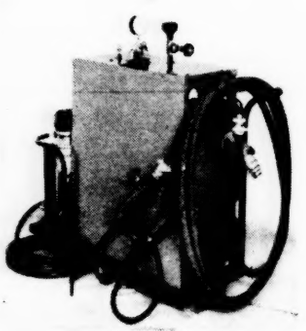
These doors provide convenient servicing of key points in plumbing, heating, and refrigeration systems by eliminating the necessity of cutting into or otherwise damaging the walls. The builder can choose precisely the door which fits his structure from among the thirty-three different styles and sizes produced. Doors come ready to install. No molding is required because the doors fit flush with the surface in which they are installed.

The doors are made in three styles and eleven sizes ranging from 8 × 8 to 24 × 36 inches. Styles are as follows: Style K has a wing of expanded metal, for plastered walls; Style L is without the expanded metal wing, for plastered walls; and Style M is for masonry, tile, wallboard, etc.

For more information, circle on Inquiry Card, **Item 29**

Electric Steam-Jet Cleaner

The JC-20 steam-jet cleaner has been introduced by Livingstone Engineering Co., Worcester 5, Mass. This new lower priced model is an all-electric, portable unit 16 inches wide and 40 inches long. It cleans machinery, equipment and facilities effectively, safely and silently and may be operated in a crowded factory or workroom without danger or annoyance to nearby operators on adjacent machines.



Unlike fuel-fired steam cleaning machines, which depend on hot water and large quantities of solvents under pressure for their cleaning action, the JC-20 uses steam from the built-in high pressure speedylectric boiler. Small quantities of solvents are used effectively and economically, for they are not diluted by mixing with gallons of water at the jet. Dirt, grease, oil and cake-on accumulations disappear before the high velocity jet of hot dry steam and solvents applied instantly as needed under push button control of the operator.

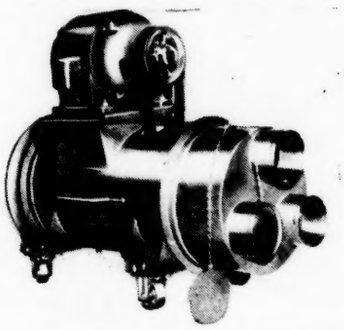
The boiler unit is free of low water danger. The boiler water itself is the electric resistance heating element and if there is no water, no current passes and no steam is generated. The boiler is available for 220, 440, or 550 volts.

Rated at 20 kw maximum, the device, under ordinary operating conditions, consumes 15 kw per hour. Even where power costs are two cents per kwh, the operating cost is only thirty cents an hour.

For more information, circle on Inquiry Card, **Item 30**

Portable Blower for Fumes

Developed primarily to expel explosive fumes from gasoline tank cars and trucks before interior repair welding is done, a specially designed application of the standard 12-inch Hartzell vaneaxial blower has been developed by Hartzell Propeller Fan Co., Piqua, Ohio. It is compact, light in weight, and extremely flexible. Mounted on industrial-type swivel casters, it can be lifted by one man, and is easily rolled from job to job.



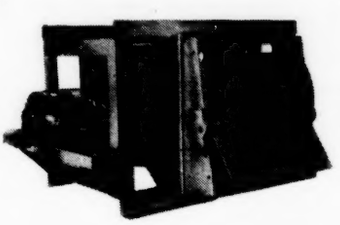
One end assembly is built with three air outlets, with shut-off gates, so that one, two or all three can be used at the same time. Thus, full air delivery can be concentrated in one large tank, or up to three small compartments can be blown out at the same time. Each outlet delivers approximately 500 cfm through 15 feet of 5-inch hose with a right-angle bend. The end assemblies can be quickly and easily reversed to pull in air, as is often done while welding is in progress.

The blower comes as a complete, self-contained unit, with built-in motor to suit the power supply of the purchaser. Air-delivery hose of any length is furnished if desired.

For more information, circle on Inquiry Card, **Item 31**

Draft Inducer and Control

A draft inducer with integral barometric draft control, for the more precise control of furnace draft, is announced by L. J. Wing Mfg. Co., Linden, N. J.



Wing draft inducers are now equipped with variable speed motors and can be equipped with integral barometric dampers, the combination of which permits the operator to achieve highest combustion efficiency. An important feature of the barometric control is a hinged explosion gate to relieve any excessive pressures that may develop in the breeching, thus preventing damage to the heating system.

For more information, circle on Inquiry Card, **Item 32**

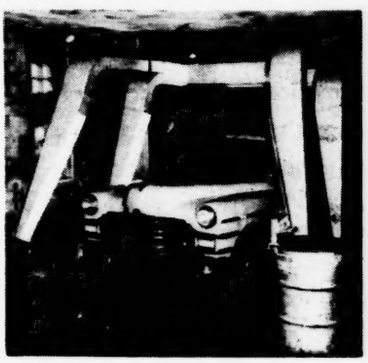
PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Direct Fired Unit Dries Cars

PROBLEM: In a South Bend, Indiana, auto laundry, a low cost system for drying newly washed cars was required to speed up production.

SOLUTION: A direct fired Dravo Counter-flo heater, with a capacity of 400,000 Btu per hr and handling 4,500 cfm, is located on the floor of the building along a side wall midway between two car door openings. Two of the three air discharge outlets on the heater are connected to sheet metal duct-work arranged in an arbor through which the cars are driven. The third nozzle discharges warm air into the building for comfort heating. The main duct of the drying assembly is 12 by 12 inches. Four 6 by 4 branch ducts extend nearly down to the floor, straddling the drag chain conveyor which moves cars along the laundry production line. Each duct, including the main overhead and the four vertical ducts, is slotted with an opening ¾ inch wide by five feet long through which warm air is directed on the cars at high velocity.

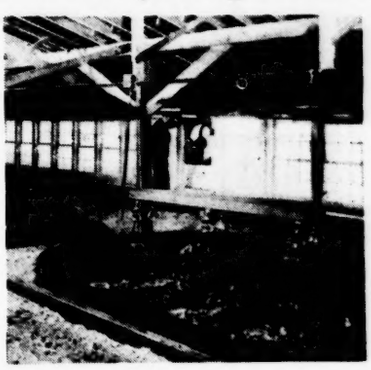


RESULTS: Car surfaces are dried without causing spots on finish. Drying duct is especially useful in winter when cars have snow and ice on them. The building remains comfortable for employees. During the summer, fans operate to perform the drying function without burning fuel in the heater.

Heat Lamps Used in Commercial Chicken Brooder

PROBLEM: The Townsend, Inc. poultry farm near Millsboro, Delaware, was seeking a suitable replacement for conventional coal stove heaters used in brooder houses. While fuel for the stoves was inexpensive, the time required to tend numerous stoves and the danger of fire and coal gas made an alternative method of heating brooder houses imperative.

SOLUTION: When Townsend was planning to add a new broiler house, the Delaware Power & Light Co. suggested a new method be tried of brooding chicks—the use of controlled radiant energy produced by infrared lamps. This method was proposed by engineers of the General Electric Co. A test flock of 900 chicks had been grown at the University of Delaware under the direction of K. C. Seeger. It was found that chicks thrived under infrared lamps without hovers even in a refrigerated room at 12F below zero. Tests encouraged Townsend to go ahead and the new broiler house was equipped with GE 250-watt infrared lamps. The house accommodates 20,000 chicks. Lamps are installed in 38 units. All these lamps are placed 19 inches from the floor initially and raised each week to accommodate growth of chicks. Thermostats are set to regulate voltage on the lamps to maintain correct energy level, depending on air temperature in the house and the age of the chicks.

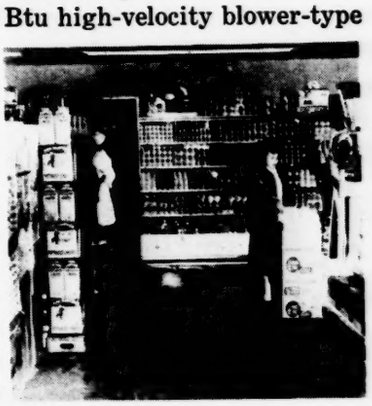


RESULTS: In addition to good brooding conditions and the saving in labor, other advantages of the infrared system included improved condition of the litter and elimination of crowding chicks together under hovers.

Blower Heaters Warm Open-Front Stores

PROBLEM: To heat open-front buildings, 100% exposed to in-rushing cold air. At the Sel-Rite Market, Los Angeles, the store front is 100 ft wide, completely open and exposed to cold northerly winds. The store is a cement block building more than 100 ft deep, and the sales area embraces 10,000 sq ft.

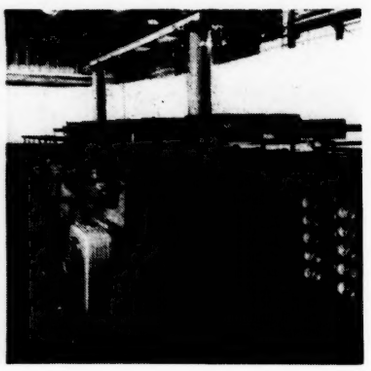
SOLUTION: Five 50,000 Btu high-velocity blower-type heaters of the Kilbury Speedheater type were installed in the rear portion of the store to heat and expand the inside air and create an interior store air pressure to dam back the incoming cold air at the front. The heaters were mounted no more than seven to eight feet above the floor, and the warm air, at high velocity, was beamed downward into open aisles and clearings. The object is to keep the warm air from recurving towards the ceiling by forcing it down to the floor and thoroughly mixing it with the cold air.



RESULTS: Temperature inside the store before turning on the heaters was 41F, according to Joe Cordak, store manager, but in a short time it raised to 70F and was surprisingly uniform throughout the store. Cold air could be detected moving along the floor into the exposed store front for a maximum penetration of 15 ft and a compensating outflow of warm air could be detected near the ceiling, but in between there was little or no air motion. Outside wind conditions seemingly had little if any effect on temperature and currents within the store.

Unit Heater Standard Part of Plating Machine

PROBLEM: The Crown Rheostat & Supply Company manufacture complete automatic return type plating machines which include equipment for the complete process from cleaning, rinsing, acid dip and plating to finished rinsing and drying operations following plating. The drying section of the machine requires a constant easily controlled supply of warm air.



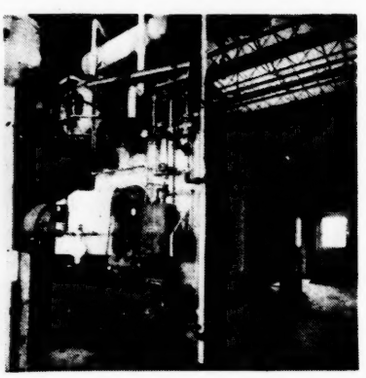
SOLUTION: A Modine horizontal delivery unit heater is furnished as a standard part of the drying section and is fastened to the side of the machine. The heater takes in room air, heats and delivers it to the plated parts to accomplish the drying operation.

RESULTS: Controlled by one workman, the machine automatically performs the entire plating and processing operation.

Steam Generator Keeps Oil Flowing

PROBLEM: At an eastern bulk storage plant of a major refinery, heavy oils are stored and required to be pumped during all kinds of weather.

SOLUTION: A Foster Wheeler packaged steam generator was installed and used primarily to heat the heavy oils to a viscosity suitable for pumping and transporting. The unit also furnishes steam for heating the refinery office.



RESULTS: Fully automatic control of the steam generator enables oil to be pumped under all conditions, and steam requirements for both oil heating and office comfort are met.

X-Ray Locates Pipe Weakness, Prevents Damage

PROBLEM: Locating points of approaching failure in water lines, and determination of areas in floors and walls through which holes can be drilled without hitting interference are frequently serious problems. The latter is particularly difficult when the architect's drawings are no longer available. For instance, where a straight pipe line had to be run through two floors and a roof and no plans were extant, it was necessary to know that no beams, wiring, or other interference would be met.

SOLUTION: A small capsule of radium was placed above the floor and photographic film attached to the ceiling below. After suitable exposure and development, the 14 x 17 film showed the pipes, beams, and chief make-up of the floors and roof.

RESULTS: From these radiographs it became possible to plan the line so that no obstructions were met.

Sam Tour & Co., Inc., 44 Trinity Place, New York 6, N. Y., points out that several non-destructive test methods are available to construction industry. Large areas can be probed without film by proper application of a suitably sized source of gamma radiation in conjunction with the use of a Geiger-Muller detector. New ultrasonic test equipment is being developed for measuring the thickness of solid concrete.

Vermiculite Concrete Raises Floor Panel Output

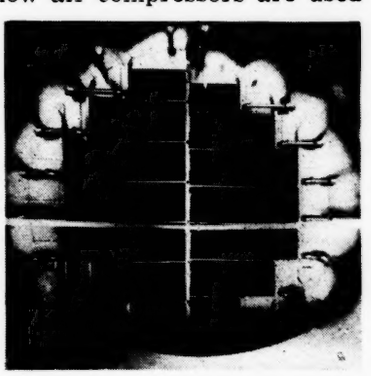
PROBLEM: One of the problems connected with slab-on-ground radiant heating installations is the loss of heat downward. This heat loss is particularly significant where electric cables are used as a heating element.

SOLUTION: For an electric heating system developed by Reuben S. Tice of Monterey, California, a heating cable using low voltage and high current is insulated against ground losses by Zonolite concrete making use of lightweight vermiculite aggregate. Vermiculite insulation of walls and in the attic helps to keep heat losses down. Vermiculite plaster walls are said to aid in rapid morning pick-up by cutting the heating-up period in approximately one-half.

RESULTS: The electric radiant heat assembly, including controls and transformer for an average five-room house requires slightly more space than an ordinary typewriter.

Giant Radiator Dissipates Air Compressor Heat

PROBLEM: At the supersonic wind tunnel of the NACA at Ames Aeronautical Laboratory, Moffett Field, California, axial flow air compressors are used to produce the required velocities in tunnel. The heat of the compressor and the heat generated by two Westinghouse 25,000 hp induction motors caused a serious problem.



SOLUTION: A giant radiator was constructed across the closed circuit wind tunnel so that air directed to the radiator was cooled by the circulation of water.

RESULTS: Air in the wind tunnel is circulated at acceptable temperatures.

Experience is my Classroom

By T. W. REYNOLDS

• ADDING PUMP CAPACITY

When the engineer selects a vacuum return heating pump he usually specifies it on the basis of its capacity in terms of square feet of radiation. However, if the selection is left to the manufacturer of the pump he no doubt will select mainly on the basis of air capacity required, and rightly so, for the removal of air is the most important factor in a vacuum heating job.

Assume, for example, an existing 15,000 sq ft duplex vacuum pump to which in time is added a load of 5,000 sq ft of radiation. Should we, then, (a) add a duplex pump for 5,000 sq ft, (b) replace with a new duplex pump of 20,000, or 25,000 sq ft capacity, or (c) merely add a single booster air pump of sufficient air capacity. The last mentioned method is the answer and the reasons for the answer are apparent in the accompanying table.

DATA ON PUMP PROBLEM

Item No.	Type of Pump	Simultaneous Capacity		Capacity, Sq Ft Rad.	Approx. Cost	Method
		Gpm of Water	Cfm of Air			
1	Air & Cond.	22.5	5.4	15,000	$1400	Existing Pump
2	Air & Cond.	7.5	2.5	5,000	1000	Add to (1)
3	Air & Cond.	37.5	8.3	25,000	1600	Replace (1)
4	Booster (Air Only)	None	21.0	None	800	Add to (1)

Adding in a second pump (2) to (1), we have a combined capacity of only 20,000 sq ft, 30 gpm and 7.9 cfm, with a cost of $1,000, whereas substituting pump (3) for (1), we have increased capacities to 25,000 sq ft, 37.5 gpm and 8.3 cfm, with a cost of $1,600. Adding a second pump (1) of equal capacity we have increased capacities still further to 30,000 sq ft, 45 gpm and 10.8 cfm, with a lesser cost of $1,400.

Still better, however, is the addition of the booster air pump (4) to (1). This method, among other advantages, not only retains the existing capacity of pump (1) at 15,000 sq ft and 22.5 gpm, but jumps the most important item of air capacity up to 21 cfm (greatly to improve the job), or even to 26.4 cfm if both pumps are operated also for air removal. Even more important is the cost, which is only $800.

As for the conservative rating of pump (1) at 15,000 sq ft where we need 20,000 sq ft, this deficiency is of no factor since water capacity of the pump of 22.5 gpm is the quantity of steam condensed for 45,000 sq ft of radiation and pump (1) is therefore over size, if anything, insofar as its water capacity is concerned.

Pumps as given in the table are duplex, except booster air pump (4), which is only single, because dependence can be placed for a time on duplex pump (1), should single booster air pump (4) fail. Costs and other data are based on a well-known make of pump. Pump (3) was selected at 25,000 sq ft capacity, since existing pump (1) was originally selected rather close to the proper size.

• BURNER SERVICE CHARGES

About 25 years ago we used to estimate a considerable annual service charge for oil burners when making cost comparisons with other fuels. Perhaps those estimates were justified at the time, but now, since the installation of my own burner 15 years ago, I can recall but two service charges. Of these, one was merely a cleaning which may or may not have been required. The other, due to a safety control shutting down the burner.

It seems that years of vibration had loosened a part of the protectorelay. With this part shoved back in place, all was well again and this protectorelay, although of an obsolete type today, will no doubt continue to function safely for many years yet.

• SAFETY VENT ON OIL BOILER

One of the difficulties with old coal-fired boilers was warping of the firing door. This caused in-leakage of air, thus building up a coal fire when you wanted to hold it down; furthermore, with long usage of the door, it would latch only with considerable care. When this same boiler is converted to oil, such a firing door may be used to advantage, for while the air leaks may be lightly cemented up with asbestos, the door will still open wide and quickly at the time of an explosion of gases within the combustion chamber.

Sometimes the cleanout door on the smoke hood may be, in effect, hinged, with only a top screw for safety vent of exploding gases, but the opening of the firing door affords the quickest and greatest relief. The firing door latch should even be filed so that it stays latched when normally required, yet easily and quickly opens when safety so requires.

Abstracts AND Reviews

Publications abstracted in this department should be ordered direct from publisher.

ECONOMIC ASPECTS OF ATOMIC POWER

So much attention has been directed to the use of atomic power as an implement of warfare, that it is refreshing to find that a serious study and investigation has been made concerning the economic effects of peacetime applications of atomic power. The authors, Sam H. Schurr and Jacob Marschak, in their book considered the generation of electricity from heat caused by nuclear reactors, and the transportation of low temperature heat over short distances, as for residential heating.

This story of the economics of atomic power was financed by The Rockefeller Foundation which gave a grant to the Cowles Commission for Research in Economics, The University of Chicago. An additional grant to complete the study was made by the Life Insurance Association of America.

The authors point out that the study is still only exploratory, for the technology of power-making reactors is still in the experimental stage, and the book involves an attempt to formulate an economic theory of the effects of a very important invention. They present an analytic study of the potential applicability of atomic power in several industries which are or may become important consumers of electricity or heat.

The text is divided into three parts: Part 1 covers economic comparisons of atomic and conventional power; Part 2, atomic power in selected industries as aluminium, chlorine and caustic soda, phosphate fertilizers, cement, brick, glass, iron and steel, railroad transportation, and residential heating; Part 3, atomic power and economic development.

Economic Aspects of Atomic Power, by S. H. Schurr and J. Marschak. Cloth bound, 6½ x 10 inches, 289 pages. Published by Princeton University Press, Princeton, N. J. Price, $6.

MODERN AIR CONDITIONING, HEATING AND VENTILATING

Ten years have elapsed since the publication of the first edition of Modern Air Conditioning, Heating and Ventilating, by the late Dr. W. H. Carrier, R. E. Cherne and W. A. Grant, at that time all associated with the Carrier Corp. This book was widely used by engineers and as a textbook in colleges.

The second edition has just been published with considerable new material added. The page size has been increased from the 6 x 9 inches of the first edition to 7 x 10 inches. In addition, larger type and illustrations are used so that the book has greater readability as compared with the first edition.

This book should prove of value not only to the practicing engineer but also to those interested in a sound applications handbook and instruction manual. The text and the illustrations are very well presented for engineers and students.

Much of the material has been used by the authors in the schools conducted by Carrier Corp. for training technical graduates for application engineering assignments. It also contains a mass of data developed and used by Carrier Corp.

The chapter on Psychrometrics has been entirely rewritten and it includes the new Carrier psychrometric chart. New material has been added by the authors on oil burner applications, panel heating, new techniques in air cleaning and purification, a functional analysis of central conditioning systems, and fundamental treatment of automatic control, comfort, and refrigeration. Included in this edition are fundamental data on cooling and dehumidification, basic heat transmission formulas, and new information on axial flow fans.

The authors present an effective method for estimating heat loads, practical design data on air duct systems, original material on air distribution and zoning, and a critical analysis of air cleaning problems.

The text includes chapters on psychrometrics, comfort, estimating requirements, heat-producing and distributing equipment, steam and hot water heating systems, automatic controls and zoning fans, heaters, ventilators, air cleaning devices and humidifiers, design of duct systems, cooling and dehumidification, central and unit systems, refrigeration systems and equipment; refrigeration piping, controls, noise and vibration, application practice, and residential heating and air conditioning.

Modern Air Conditioning, Heating and Ventilating, by W. H. Carrier, R. E. Cherne and W. A. Grant. Cloth bound, 7 x 10 inches, 574 pages. Published by Pitman Publishing Corporation, 2 West 45th St., New York 19, N. Y.

• • •

ANTHRACITE FINES ON CHAIN-GRATE STOKER—How to use efficiently anthracite barley and rice coal—on traveling or chain-grate type stokers is sketched in a report issued by the Bureau of Mines, U. S. Department of the Interior. Unless the equipment is especially designed for its use, careful maintenance and operation are particularly necessary if satisfactory results are to be obtained with barley. Report of Investigations 4720, Burning Anthracite Barley on a Chain-Grate Stoker in a Two-Arch Furnace, may be obtained by writing to the Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

PLANT MAINTENANCE SHOW AND CONFERENCE—2nd plant maintenance show and conference, at the Auditorium, Cleveland, Ohio. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. .....**JANUARY 15-18, 1951.**

LOUISIANA ENGINEERS' MEETING—The 1951 Statewide annual meeting of the Louisiana Engineering Society, at the St. Charles Hotel, New Orleans, La. George Elmer May, publicity committee, 317 Baronne St., New Orleans, La. ..... **JANUARY 18-20, 1951.**

ASHVE MEETING—57th annual meeting of the American Society of Heating and Ventilating Engineers, at the Bellevue-Stratford, Philadelphia, Pa. A. V. Hutchinson, secretary of the Society, 51 Madison Ave., New York 10, N. Y. .....**JANUARY 22-25, 1951.**

ASHVE EXPOSITION—10th International Heating and Ventilating Exposition under the auspices of the American Society of Heating and Ventilating Engineers, at the Commercial Museum, Philadelphia, Pa. Charles F. Roth, manager of the International Exposition Company, Grand Central Palace, New York 17, N. Y. .....**JANUARY 22-26, 1951.**

ASME MEETING—Spring meeting of the American Society of Mechanical Engineers, at the Hotel Atlanta-Biltmore, Atlanta, Ga. C. E. Davies, secretary of the Society, 29 W. 39th St., New York, N. Y. .....**APRIL 2-5, 1951.**

LUBRICATION SHOW — Annual convention and lubrication show of the American Society of Lubrication Engineers, at the Bellevue-Stratford Hotel, Philadelphia, Pa. W. F. Leonard, secretary of Society, 343 South Dearborn Street, Chicago 4, Ill. .....**APRIL 16-18, 1951.**

FOUNDRYMEN'S CONVENTION—55th annual convention of the American Foundrymen's Society, in Buffalo, New York. William W. Maloney, secretary-treasurer of the Society, 616 S. Michigan Ave., Chicago 5, Ill. .....**APRIL 23-26, 1951.**

REFRIGERATION MEETING—Annual meeting of the Refrigeration Equipment Manufacturers Association, at The Homestead, Hot Springs, Va. George E. Mills, public relations director, REMA, 1346 Connecticut Ave., N.W., Washington, D. C. .....**APRIL 30—MAY 2, 1951.**

ARCHITECTS CONVENTION—1951 convention and national seminar meetings of The American Institute of Architects, at the Edgewater Beach Hotel, Chicago, Ill. Paul Gerhardt, Jr., chairman, 121 No. LaSalle St., Chicago, Ill. **MAY 8-11, 1951.**

NDHA MEETING—42nd annual meeting of the National District Heating Association, at the Statler Hotel, Detroit, Mich. John F. Collins, Jr., secretary-treasurer of the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa.....**JUNE 5-8, 1951.**

INSTRUMENT CONFERENCE AND EXHIBIT—1951 Instrument conference and national exhibit of the Instrument Society of America, at the Coliseum, Houston, Tex. John McCaffery, assistant executive secretary of the Society, 921 Ridge Ave., Pittsburgh 12, Pa. .....**SEPTEMBER 10-14, 1951.**

REFRIGERATION SHOW—7th All-Industry Refrigeration and Air Conditioning Exposition, at Navy Pier, Chicago, Ill. Show director, REMA, 1346 Connecticut Ave., N.W., Washington, D. C. .....**NOVEMBER 5-9, 1951.**

These men are working for you

Astute, efficiency-minded J. A. Henby, Vice President in charge of Production, checks on location of new equipment.

Fred Smith, deliberate, analytical Chief Metallurgist, inspects chemical composition test being run on steel tubing.

Keen-eyed, thorough Fred Brown, Chief Inspector, uses micrometer of special design to check hard-to-reach point.

John Ochs, forceful, energetic Superintendent, Fittings Forging Department, smiles over another production record.

GOOD SERVICE right down the line is a tradition at Tube Turns, Inc. And with our production management, good service starts with a quality product—one you can always depend on . . .

That's why an officer of Tube Turns, Inc., is in full charge of production . . . why a noted metallurgist heads up a staff of laboratory technicians who make dead certain that only the finest seamless steel tubing goes into production . . . why a man who helped Tube Turns pioneer welding fittings today supervises the forging process . . . why a veteran inspector and more than 30 trained assistants make no less than 15 visual and instrumental inspections of *each fitting* . . .

These, of course, are the good, sound reasons why you can depend on Tube-Turn welding fittings and Tube Turns' service, always . . . *and all ways!*

"Be Sure You See The Double tt"

TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

DEGREE-DAYS FOR OCTOBER, 1950

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING'S 23rd Year of Publication of Monthly Degree-Day Data

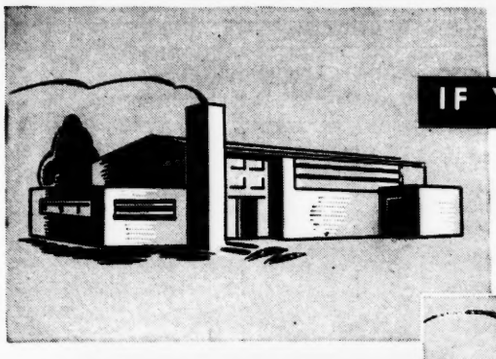
City	October			Cumulative, September 1 to October 31			Heating Season[1]
	1950	1949	Normal	1950	1949	Normal	Normal
Abilene, Texas (A)	9	137	0	9	143	0	2061
Albany, New York (A)	380	343	446	595	551	518	6580
Albuquerque, New Mexico (A)	20	290	273	47	296	273	4298
Alpena, Michigan (C)	413	417	570	681	677	792	8299*
Anaconda, Montana (C)	599	828	647	998	1131	982	8357**
Asheville, North Carolina (C)	119	141	276	173	241	276	4232
Atlanta, Georgia (C)	31	41	96	45	64	96	2890
Atlantic City, New Jersey (C)	163	117	254	240	174	254	5176
Augusta, Georgia (A)	20	10	16	35	14	16	2161
Baker, Oregon (C)	434	686	552	670	850	810	7163
Baltimore, Maryland (C)	147	98	223	208	145	223	4533
Billings, Montana (A)	409	717	524	695	920	713	7119
Binghamton, New York (C)	393	315	453	592	515	561	6808
Birmingham, Alabama (A)	43	39	0	44	64	0	2352
Bismarck, North Dakota (A)	496	646	626	728	918	848	9192
Block Island, Rhode Island (C)	256	191	279	381	269	279	5788
Boise, Idaho (A)	261	576	434	403	666	536	5552
Boston, Massachusetts (A)	281	230	363	430	335	411	6045
Bozeman, Montana (C)	568	817	651	1028	1099	987	8521**
Buffalo, New York (A)	324	273	419	479	479	494	6822
Burlington, Iowa (A)	211	284	(a)	290	466	(a)	(a)
Burlington, Vermont (A)	445	378	481	739	575	625	7514
Butte, Montana (C)	594	851	655	1041	1177	999	8235**
Cairo, Illinois (C)	59	135	158	80	188	158	3909
Canton, New York (C)	452	382	557	738	619	746	8020
Charleston, South Carolina (C)	3	0	0	5	0	0	1769
Charlotte, North Carolina (C)	47	58	115	85	86	115	3120
Chattanooga, Tennessee (A)	57	69	105	68	105	105	3118
Cheyenne, Wyoming (A)	375	666	605	675	884	845	7466
Chicago, Illinois (C)	186	224	326	227	350	402	6077
Cincinnati, Ohio (C)	110	146	254	156	232	254	4684
Cleveland, Ohio (A)	246	229	366	323	409	393	6155
Columbia, Missouri (C)	130	227	260	173	339	260	4922
Columbia, South Carolina (C)	23	23	31	44	36	31	2364
Columbus, Ohio (C)	175	187	313	243	317	313	5398
Concord, New Hampshire (A)	439	427	484	726	661	652	7353
Concordia, Kansas (C)	141	242	276	191	338	276	5315
Dallas, Texas (A)	5	110	0	5	115	0	2256
Davenport, Iowa (C)	185	256	363	240	408	363	6289
Dayton, Ohio (A)	209	236	273	303	418	273	5264
Deer Lodge, Montana (C)	629	787	733	1046	1097	1132	8672**
Denver, Colorado (C)	159	451	428	328	527	500	5874
Des Moines, Iowa (A)	204	276	357	269	412	357	6384
Detroit, Michigan (A)	284	270	400	390	452	442	6490
Devils Lake, North Dakota (C)	598	701	706	849	1002	982	9970
Dodge City, Kansas (A)	131	279	276	184	348	948	5035
Dubuque, Iowa (C)	234	304	409	309	494	445	6790
Duluth, Minnesota (C)	565	558	626	809	873	896	9483
Eastport, Maine (C)	514	426	543	848	664	819	8520**
Elkins, West Virginia (A)	311	270	378	476	490	441	5697
El Paso, Texas (A)	0	139	40	0	139	40	2428
Ely, Nevada (A)	422	679	(a)	741	862	(a)	(a)
Erie, Pennsylvania (C)	241	219	378	342	366	414	6273
Escanaba, Michigan (C)	464	464	591	721	769	834	8771
Evansville, Indiana (A)	120	172	155	163	284	155	4244
Fort Smith, Arkansas (A)	45	163	62	50	198	62	3147
Fort Wayne, Indiana (A)	262	279	347	373	481	347	5925
Fort Worth, Texas (A)	3	115	0	3	121	0	2148
Fresno, California (A)	41	142	19	51	143	19	2334
Galveston, Texas (C)	0	19	0	0	19	0	1016
Grand Junction, Colorado (A)	129	433	369	198	464	369	5548
Grand Rapids, Michigan (A)	328	266	419	438	450	476	6535
Green Bay, Wisconsin (C)	426	430	505	638	706	637	7825
Greensboro, North Carolina (A)	112	114	143	174	166	143	3529
Greenville, South Carolina (A)	41	58	146	72	99	146	3380
Harrisburg, Pennsylvania (A)	271	201	329	388	317	329	5375
Hartford, Connecticut (A)	315	257	344	498	389	392	6036
Hatteras, North Carolina (C)	6	9	0	14	10	0	2571
Havre, Montana (C)	531	688	620	813	899	890	8700
Helena, Montana (A)	528	791	614	888	1092	865	7894**
Houston, Texas (C)	0	32	0	0	32	0	1157
Huron, South Dakota (A)	396	503	526	542	718	649	8004
Indianapolis, Indiana (A)	199	221	298	277	376	298	5298
Jackson, Mississippi (A)	17	36	(a)	17	46	(a)	(a)
Kansas City, Missouri (A)	116	195	219	150	274	219	4956
Knoxville, Tennessee (A)	70	83	183	97	133	183	3670
La Crosse, Wisconsin (A)	330	376	462	468	623	558	7322
Lander, Wyoming (A)	418	792	654	773	990	930	7947

(a) Data not available.

[1]Figures in this column are normal totals for a complete heating season, September to June, inclusive.

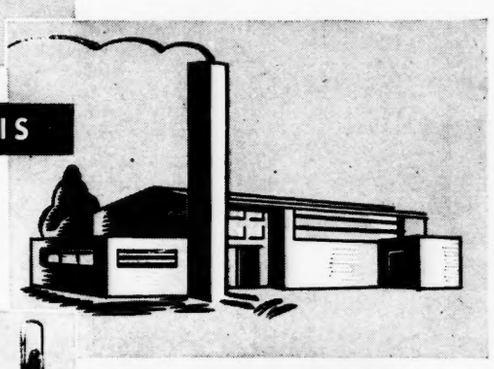
Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table concluded on page 1121]



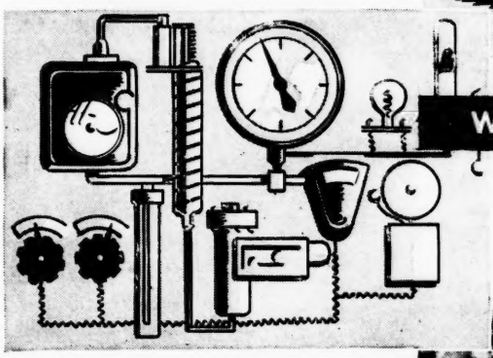
IF YOU WANT THIS

The modern functional school is characterized by trim lines and concise design . . . a low chimney.



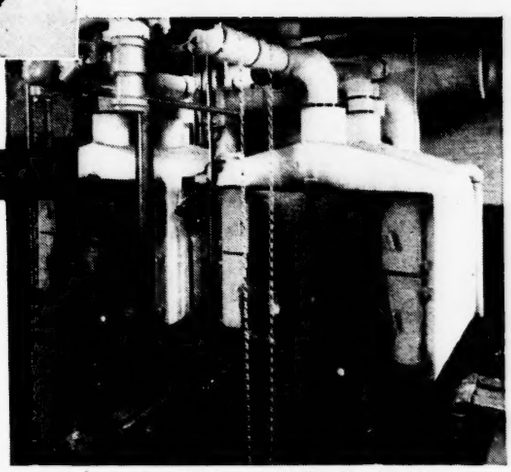
INSTEAD OF THIS

Conventional types of horizontal, return-flue or tube boilers require tall, long-draft chimneys out of keeping with building style.



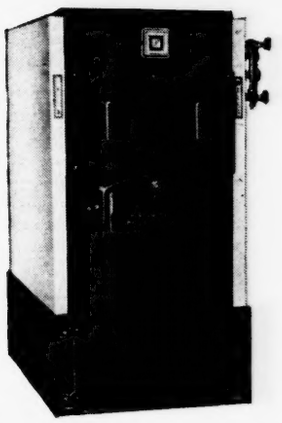
WITHOUT THIS

Complicated controls and noise of operation are necessary adjuncts when a "package unit" boiler is used with a low chimney.



USE THIS

H. B. Smith *low-draft* cast iron boilers meet all heating requirements without tall chimneys or extra controls. This installation is in a Connecticut school.



SMITH-MILLS "20" BOILER for Hand Firing. These smaller H. B. Smith Boilers have the same vertical flue travel, hence the same low-draft requirements as do the famous big "MILLS" Boilers.

SMITH-MILLS "1100" BOILER-BURNER UNIT. A complete heating plant for the average home — equipped with oil burner and tankless heater. Extended type jacket available.

Minimum draft resistance is assured in the design of H. B. Smith boilers. The hot gases rise between the gray iron vertical water tubes before passing into the side flues. Maximum heat is transferred from the gases to the water in the tubes.

Boilers of the return-flue, or long-fire-tube type, require stronger draft — call for tall chimneys or mechanical draft with elaborate controls . . . none of which are needed with H. B. Smith low-draft boilers.

Result? Low chimneys and freedom from noise, vibration or the danger of draft-control instrument failure. Add space saving, extra long life, economy of operation, low maintenance costs—and sectional construction features that permit the boiler to *grow with the need* — and you see why architects, engineers and contractors recommend H. B. Smith Boilers with full confidence.

You may be interested to know that H. B. Smith manufactures the most complete line of modern cast iron boilers in the world. Let us help you satisfy your customers with convincing data and case histories.

H. B. Smith

CAST IRON BOILERS

THE H. B. SMITH CO. INC., WESTFIELD, MASS.

Most complete line in the world of cast iron boilers for heating

Degree-Days for October, 1950 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 23rd Year of Publication of Monthly Degree-Day Data

City	October			Cumulative, September 1 to October 31			Heating Season[1]
	1950	1949	Normal	1950	1949	Normal	Normal
Lansing, Michigan (A)	339	335	481	493	582	595	7048
Lewiston, Maine (O)	480	424	501	780	625	666	7707
Lincoln, Nebraska (C)	191	268	316	255	390	316	5999
Little Rock, Arkansas (A)	38	115	47	52	142	47	2811
Livingston, Montana (C)	474	709	523	834	944	750	7245**
Los Angeles, California (C)	2	54	0	2	54	0	1504
Louisville, Kentucky (A)	115	152	186	155	245	186	4180
Lynchburg, Virginia (A)	154	142	220	229	227	220	3980
Macon, Georgia (A)	11	10	6	16	15	6	2201
Madison, Wisconsin (C)	292	323	459	408	543	546	7429
Marquette, Michigan (C)	476	432	567	725	731	792	8693*
Memphis, Tennessee (A)	48	111	62	58	140	62	2950
Meridian, Mississippi (A)	25	31	22	27	43	22	2160
Milwaukee, Wisconsin (A)	293	357	450	429	560	534	7245
Minneapolis, Minnesota (A)	358	376	481	458	587	574	7850
Montgomery, Alabama (A)	6	13	0	7	18	0	1884
Nantucket, Massachusetts (A)	323	287	335	497	389	398	5957
Nashville, Tennessee (A)	69	121	136	88	164	136	3507
New Haven, Connecticut (A)	282	241	360	430	349	399	5895
New Orleans, Louisiana (C)	0	10	0	0	10	0	1024
New York, N. Y. (C)	174	123	272	261	176	322	5274***
Nome, Alaska† (A)	613	553	744	613	553	744	14580**
Norfolk, Virginia (C)	47	43	99	73	55	99	3350
North Head, Washington (C)	393	451	366	677	652	621	5452**
North Platte, Nebraska (A)	288	452	434	421	608	476	6366
Oakland, California (A)	117	221	183	176	259	273	3143**
Oklahoma City, Oklahoma (C)	43	171	105	46	209	105	3613
Omaha, Nebraska (A)	202	280	329	279	417	329	6131
Oswego, New York (C)	357	281	459	555	453	573	7088
Parkersburg, W. Virginia (C)	172	172	285	245	299	285	4775
Peoria, Illinois (A)	191	266	381	253	434	384	6109
Philadelphia, Pennsylvania (C)	166	118	235	251	164	271	4737***
Phoenix, Arizona (C)	0	49	0	0	49	0	1405
Pittsburgh, Pennsylvania (C)	204	192	313	282	312	313	5235
Pocatello, Idaho (A)	386	697	499	626	827	655	6655
Portland, Maine (A)	484	419	477	796	658	639	7218
Portland, Oregon (C)	352	432	332	442	491	437	4469
Providence, Rhode Island (C)	272	231	348	435	331	411	6015
Pueblo, Colorado (A)	155	418	388	242	461	394	5514
Raleigh, North Carolina (C)	61	57	130	107	83	130	3234
Rapid City, South Dakota (A)	347	554	515	580	738	659	7118
Reading, Pennsylvania (C)	230	166	344	333	259	344	5389
Red Bluff, California (A)	96	112	(a)	104	114	(a)	(a)
Reno, Nevada (A)	355	534	453	556	673	597	5892
Richmond, Virginia (C)	119	105	161	173	141	161	3695
Rochester, New York (A)	349	315	431	518	524	503	6732
Roseburg, Oregon (C)	(a)	443	350	(a)	494	461	4428
Roswell, New Mexico (A)	36	262	186	37	269	186	3484
Sacramento, California (C)	72	132	71	80	135	71	2653
St. Joseph, Missouri (A)	148	233	248	201	339	248	5161
St. Louis, Missouri (C)	102	175	205	127	245	205	4585
Salt Lake City, Utah (A)	225	520	388	360	578	406	5555
San Antonio, Texas (A)	0	40	0	0	40	0	1202
San Diego, California (A)	5	60	34	5	61	34	1645
Sandusky, Ohio (C)	216	199	353	278	319	353	6208
San Francisco, California (C)	107	218	146	229	324	260	3264**
Sault Ste. Marie, Michigan (A)	534	507	623	862	862	899	9285**
Savannah, Georgia (A)	6	0	0	7	1	0	1490
Scranton, Pennsylvania (C)	298	259	397	467	425	457	6129
Seattle, Washington (C)	381	433	394	509	545	580	4934**
Sheridan, Wyoming (A)	403	696	636	709	929	900	8008
Shreveport, Louisiana (A)	10	81	0	12	90	0	1938
Sioux City, Iowa (A)	288	358	415	384	538	448	6898
Spokane, Washington (A)	561	644	515	705	799	707	6355
Springfield, Illinois (C)	133	216	282	174	312	282	5373
Springfield, Missouri (A)	120	232	217	181	338	217	4428
Syracuse, New York (A)	357	297	425	559	477	521	6893
Tacoma, Washington (C)	418	477	400	589	633	607	5181**
Terre Haute, Indiana (A)	183	220	233	247	358	233	4872
Toledo, Ohio (A)	281	263	369	386	466	378	6077
Topeka, Kansas (C)	109	208	236	141	287	236	4969
Trenton, New Jersey (C)	224	167	242	342	251	242	4933
Utica, New York (O)	388	231	430	610	377	612	6796
Valentine, Nebraska (C)	329	522	490	511	712	583	7039
Walla Walla, Washington (C)	334	443	332	410	507	362	4808
Washington, D. C. (C)	149	116	251	204	171	251	4626
Wichita, Kansas (A)	99	218	192	127	277	192	4673
Williston, North Dakota (C)	255	682	660	829	959	930	9323
Winnemucca, Nevada (C)	395	631	507	622	757	699	6427**
Yakima, Washington (A)	520	547	437	651	674	557	5599

(a) Data not available.

†Nome data are for September.

*Includes August.
**Includes July and August.
***New 48-year normal covering 1898 to 1946.

[1]Figures in this column are normal totals for a complete heating season, September to June, inclusive.

Bryant Industrial Hi-Flo BLOWERS

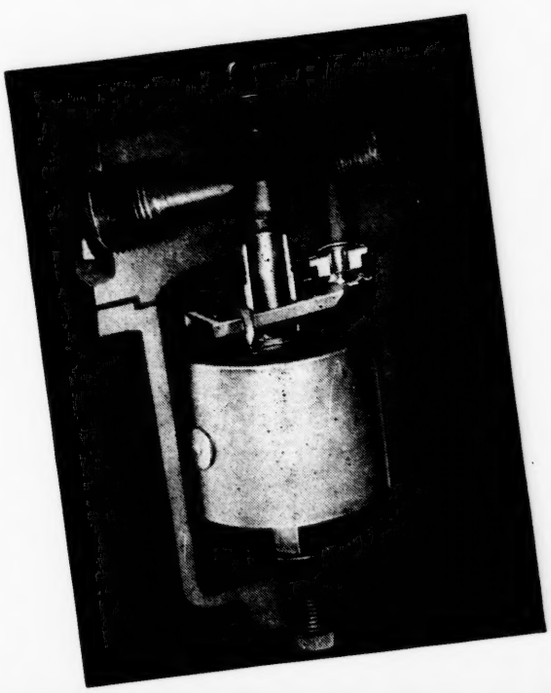
Bryant Power Boiler Burner applied to 50-HP Scotch Marine Boiler to develop 100HP. Important feature of assembly is *Hi-Flo* Blower which assures constant pressure and pulsation-free air at all times. Note well-engineered compactness of assembly, typical of Bryant Industrial Combustion Equipment.

CONSTANT AIR PRESSURE FOR EFFECTIVE COMBUSTION

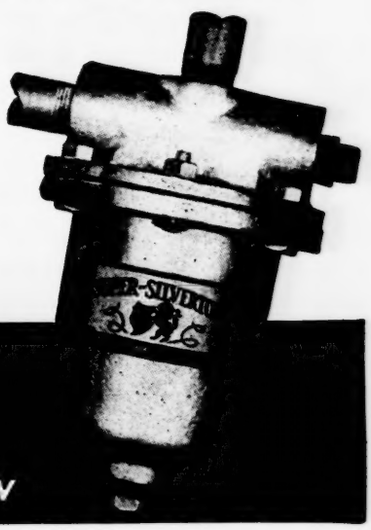
• Where constant air pressure is a *must,* use Bryant *Hi-Flo* Blowers. They maintain *constant* air pressure throughout their entire range of capacity, using *one burner or many.* *Hi-Flo* Blowers feature lightweight aluminum construction and *smooth* operation. Supplied in 4-ounce, 10 to 12-ounce and 16 to 18-ounce pressure ranges. Write for Data Sheet 6A-4 for complete information and specifications. Bryant Industrial Division, Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10, Ohio.

GAS Bryant Industrial Division
COMBUSTION FOR INDUSTRY
AFFILIATED GAS EQUIPMENT, INC.

The Inside Story On *WHY YOU SAVE* *with* SUPER-SILVERTOPS



In this cutaway view of an Anderson Super-Silvertop Steam Trap, you can see that all pipe connections are in the head of the trap. The alternate top inlet connection provides for elbow connection as well as straight-in-line. This means simplified piping, saving up to nine fittings, plus 40 minutes of costly installation time. See how the guided bucked permits the use of a longer lever arm with greater valve opening power. This larger valve means more capacity for the same size trap. Super-Silvertop trapping is efficient trapping . . . *the most economical you can buy.* Learn how to cut your costs by writing for the free 36-page book, "Solving Steam Trap Problems."



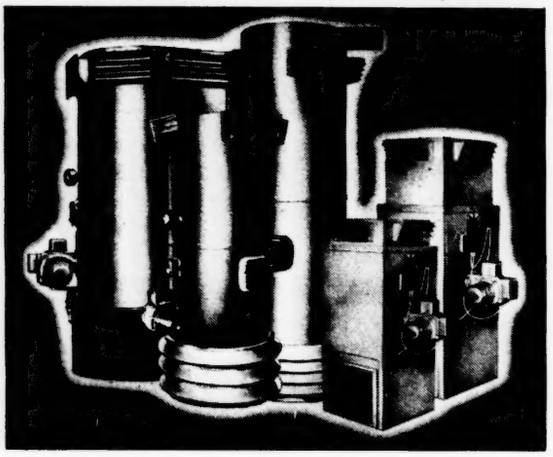
THE V. D. ANDERSON COMPANY
1943 W. 96th Street • Cleveland 2, Ohio

SUPER-SILVERTOPS
SAVE YOU MONEY
straight-in-line or as an elbow

Now . . . A COMPLETE LINE *of*
INDUSTRIAL SELF-CONTAINED UNIT HEATERS
For Any Application

THERMOPAC
(100,000 and 200,000 btu's/hr.)
HORIZONTAL SUSPENSION OR FLOOR SET

THERMOBLOC
(300,000 550,000 and 1,000,000 btu's/hr.)

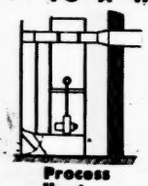


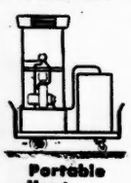
The fundamental principles of high heat transfer, simplicity and completely automatic operation have been incorporated in three new units, augmenting the two basic THERMOBLOCS that have been so well accepted. These five units offer a complete range of 100,000, 200,000, 300,000, 550,000 and 1,000,000 btu's/hr., filling every application from the smallest to the largest plant requiring multiple installations. And, THERMOBLOCS are completely automatic in operation, need no attendant.

THERMOBLOC is the ideal heater for buildings with large, unobstructed areas; freight terminals, machine shops, assembly lines and the like. Silent THERMOBLOCS are used in super markets, dance halls, auditoriums. Standard units are adaptable to many unusual heating applications, as shown below. Better get the whole story on THERMOBLOC, the most useable direct-fired heater on the market.

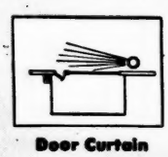
Write for the new data book containing tables and engineering data on heating constants, building materials, etc. It will aid you in determining the heating requirements of your plant. To solve your heating problems, call our engineers and let them show you the many advantages of THERMOBLOC.

STANDARD THERMOBLOCS ARE ADAPTABLE TO A WIDE RANGE OF HEATING JOBS

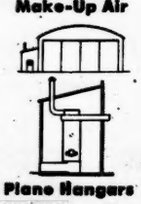

Process Heat


Portable Heat

Tempering Make-Up Air


Door Curtain

With Filters


Piano Hangers

THERMOBLOC DIVISION
PRAT-DANIEL CORPORATION
Manufacturers of P-D Power Equipment
86-12 Water Street East Port Chester, Conn.

NEWS OF THE MONTH

CONSTRUCTION OUTLOOK

forecast by annual Dodge survey is for strong year in spite of moderate cut-back.

Building and engineering contracts will decline 19% in 1951 relative to 1950 in the 37 states east of the Rockies, it is estimated in the annual November outlook of F. W. Dodge Corp., construction news and marketing specialists. The estimates are authored jointly by Thomas S. Holden, president, and Clyde Shute, assistant vice president in charge of the statistical and research division.

• **STILL STRONG.**—The decline will be a cut-back from the peak construction volume of all time, they state, and it leaves a dollar total measurably greater than that of any year except 1950, and a physical volume total that would compare favorably with other prosperous construction years.

It is questioned whether there will be much change in the level of construction costs in 1951. Some materials will be tight; others which were tight in 1950 will be plentiful and competitively priced.

Demand for building labor will ease somewhat with reduced construction volume, though doubtless many men who have been employed in construction in 1950 will shift to defense production.

• **WHY.**—The estimate attributes the moderate extent of the anticipated decline to these reasons, summarized: Partial rather than total mobilization, prospectively increased production of key materials; reduced output of motor vehicles and other consumer durables; ingenuity in conserving and substituting of materials, and the view by responsible leaders in government that a strong civilian economy with maximum freedoms is just as essential for preparedness as an enlarged military establishment.

It is expected that Regulation X of October 27 will prove to be too drastic and will be modified during 1951.

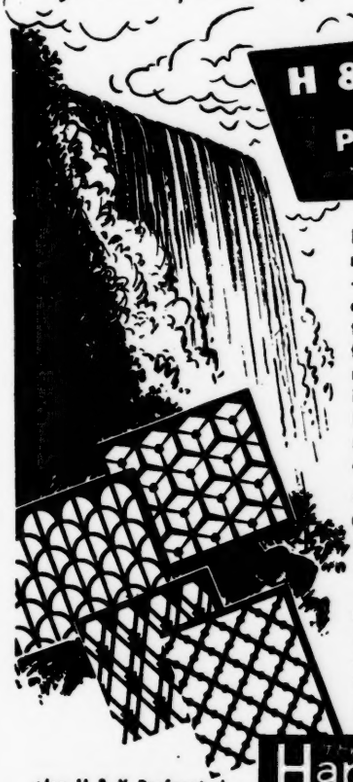
Government officials announce the intention of cutting 1951 housing production back one-third from the total 1950 volume; from approximately 1,300,000 back to 850,000 new non-farm dwelling units. The Dodge opinion is that Regulation X is quite severe and that its effect, unless modified, would be to reduce housing volume considerably more than one-third.

Single-family houses built on owners' order for owners' occupancy are likely to decline less, percentagewise, than houses built for sale by operative builders.

The report points out that the government's steps to reinvigorate the waning postwar housing boom in mid-1949, plus further credit easing in the spring of 1950, added to a free-spending mood of the public, combined to bring about a 1950 housing boom that surpassed all records and all expectations.

In one important sense that status of the construction industry is radically changed, the report says. It has suddenly been superseded by the armament industry as the government planners' favorite vehicle for

Ageless Beauty—Lifetime Utility



H & K GRILLES of PERFORATED METAL

In architectural designs — classic or modern — ornamental or functional — H & K Perforated Metal Grilles are world renowned for their beauty and lasting high quality. Perforated from durable wrought metal sheets for centuries of service! Choose from a practically unlimited variety of patterns . . . designed to harmonize with all styles of interior and exterior construction.

Choose H & K Perforated Metal Grilles of steel, brass, bronze, stainless steel or aluminum. Order them rectangular, square, round or odd . . . flat, curved or angular. H & K mass production facilities bring them to you at lower cost. Dependable H & K service gets them to you promptly. Illustrated catalog available — write for it!

Also H & K Perforated Metals and Sheet Materials for Industry

The Harrington & King Perforating Co.

5664 FILLMORE ST., CHICAGO 44, ILLINOIS
114 LIBERTY ST., NEW YORK 6, N. Y.

IT DOESN'T COST: IT PAYS

Has it ever occurred to you that when you buy heating equipment you should ask, "How much does it pay?" rather than "How much does it cost?" Look at it in that light and you will invariably specify

THERM-O-TILE

Reg. U. S. Pat. Off.

Underground Steam Conduit

Therm-O-Tile is a *permanent* structure. Always the same slope, hence no condensation pockets. Always the same high efficiency because the insulation is kept DRY. Permanently most economical.

Ask for and study Bulletin 381. You will then understand why Therm-O-Tile is so consistently specified for the important central heating projects as reported in this journal for many years.

Sold and installed by Johns-Manville Construction Units in all Principal Cities.

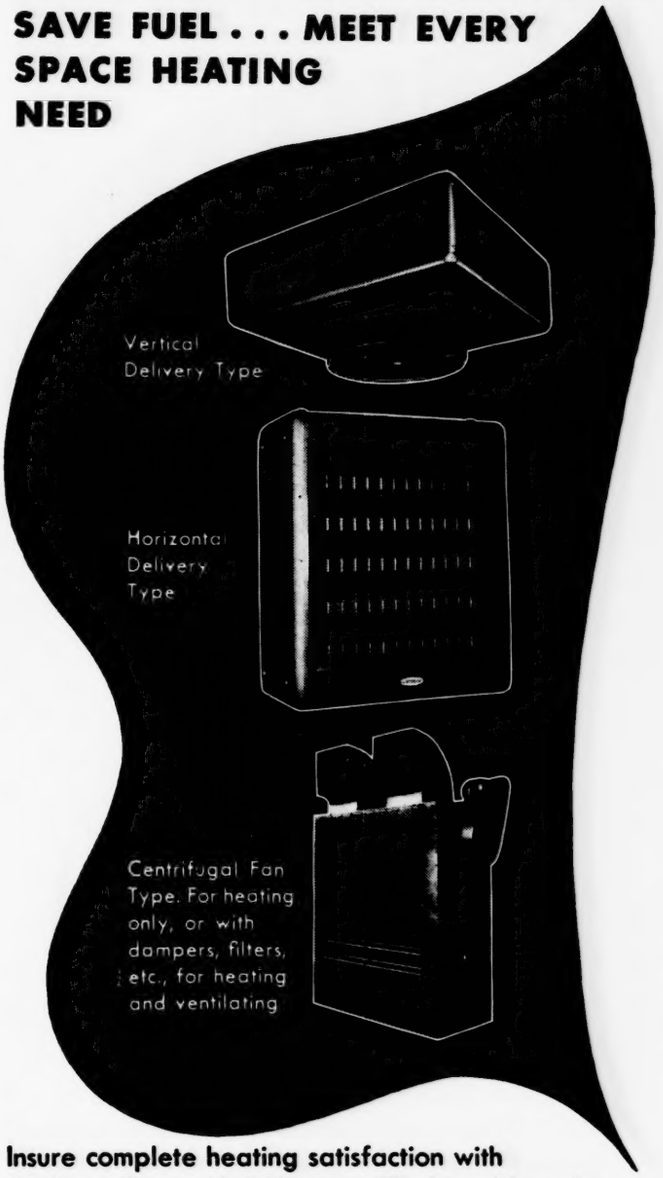
H. W. PORTER & CO., Inc.

823-V Frelinghuysen Avenue • Newark 5, N. J.

AIRTHERM

Steam Unit Heaters

SAVE FUEL . . . MEET EVERY SPACE HEATING NEED


Vertical Delivery Type
Horizontal Delivery Type
Centrifugal Fan Type. For heating only, or with dampers, filters, etc., for heating and ventilating

Insure complete heating satisfaction with Airtherm Steam Unit Heaters. The long life coils in Airtherm Unit Heaters have copper tubes and copper headers, brazed into an integral heat transfer unit.

Airtherm offers you Horizontal and Vertical propeller fan types for all commercial and industrial installations plus the Centrifugal fan type for handling large air volume, long heat throw and ductwork resistance.

For complete customer satisfaction, use Airtherm on your next job.

WRITE FOR BULLETINS No. 1208A and 402

AIRTHERM MANUFACTURING COMPANY

722 South Spring Avenue • St. Louis 10, Missouri

NOW

Get ready for Winter!

INSTALL

TODD BURNERS

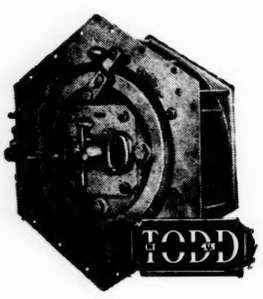
—GAS OR OIL

Now's the time to prepare for cold weather! Cut your power costs . . . modernization saves up to 10% on your fuel and maintenance bills. Let skilled Todd specialists engineer your boiler plant for maximum economy—either by modernizing obsolete equipment or providing a new and efficient installation.

Oil Burners

Gas Burners

Combination Oil and Gas Burners



COMBUSTION EQUIPMENT DIVISION

TODD SHIPYARDS CORPORATION

81-16 45th Ave., Elmhurst, Queens, N. Y.

See the Classified Telephone Book

NEW YORK • BROOKLYN • ROCHESTER • BUFFALO • HOBOKEN • NEWARK • PHILADELPHIA • HARRISBURG • YORK • PITTSBURGH • CHICAGO • RALEIGH • CHARLESTON, S. C. • BOSTON • SPRINGFIELD, MASS. • BALTIMORE • WASHINGTON • RICHMOND, VA. • ATLANTA • BIRMINGHAM • CLEVELAND • DETROIT • GRAND RAPIDS • TAMPA • GALVESTON • SAN ANTONIO • DALLAS • HOUSTON • TULSA • MOBILE • NEW ORLEANS • SHREVEPORT • DENVER • SALT LAKE CITY • LOS ANGELES • SAN FRANCISCO • SEATTLE • MONTREAL • TORONTO • BARRANQUILLA • BUENOS AIRES • LONDON

government spending and for stimulating full employment.

However, the growth momentum and the prospective expansion of the American economy are so great that a continuously large construction demand may be expected without artificial government stimulation.

The present prospect is that controls will be imposed on a more or less experimental basis. Apparently the dominant thought in responsible government circles today is that controls should be kept to a minimum.

• **BREAKDOWN.**—The F. W. Dodge estimate is that combined residential and nonresidential contract valuations in the 37 states in 1951 will decline 24% relative to 1949, but that public and private works and utilities, also known as heavy engineering, will remain at the same dollar total, to bring the total of all construction down 19%. The estimate is that nonresidential building will decline 10%, and residential 35%.

All estimates relative to 1950 are based on F. W. Dodge nine-month totals of actual contract awards, plus estimates for the last three months projected from these actual nine-month totals.

"However," the article concludes, "it must be emphasized that the possibility of sudden, unexpected, drastic action by government greatly augments the customary hazard of guessing future construction activity. More than ever it is necessary for those who make or follow advance construction estimates to review and revise their figures frequently."

AIR CONDITIONING GROWTH

stabilized, and water use not likely to be excessive, officials learn.

The amount of air conditioning being added each year has stabilized and can, in the future, be expected to follow the general business and building trend, stated R. A. Gonzalez of the Airtemp Division of Chrysler Corporation, in speaking as a member of a panel discussing air conditioning demands at the annual convention of the Chesapeake Section of the American Water Works Association in Wilmington, Delaware. Mr. Gonzalez emphasized, however, that this general observation did not apply to special uses of air conditioning and particularly not to room air conditioners, which have experienced such remarkable expansion in sales volume in the past few years.

• **CONSERVATION.**— Mr. Gonzalez said that manufacturers of air conditioning equipment are among the nation's leaders in advocating and practicing water conservation. Where water supply shortages or water disposal difficulties are being experienced by municipalities, regulations on air conditioning installations to curb the use of water would generally make only a slight contribution to the solution of a community's over-all water problem. The use and waste of water by all local commercial and industrial users requires careful survey and attention, Mr. Gonzalez stated, if

the municipality's water difficulties are to be successfully overcome.

Many factors contribute to municipal water supply and disposal problems and the factors vary in each locality, Mr. Gonzalez observed. Usually, he said, a primary reason is that the expansion of the community's water facilities have not kept pace with the growth of its commerce and industry.

• **DAYTON.** — Major expansions in all phases of the Dayton water and sewer systems were held to a minimum in the 1930's because of economic conditions, Mr. Gonzalez reported. It is interesting to note that in Dayton the water pumped in 1940 was just 1% more than the water pumped in 1930. The population had increased 5% in that period. So there was no cause for alarm until the war years came along. Using 1940 pumping as a base, by 1944 the pumping was 153% of the 1940 pumping, whereas the population had increased by only 6%. Power consumption was up 41% and telephone instruments in use were up 52%. When 1945 pumping was less than 2% above 1944, there was reason to hope that a leveling off point had been reached. This proved a false hope. By 1948, still using 1940 as a base, water pumping was up 95%; population was up 22%; power, 122%; and telephones up 144%.

It is interesting to note, he said, that the population figures do not relate themselves to the water pumping. A search was made to find something that would relate fairly closely to the water pumping. It was found that the curves of power usage and telephone instruments in use did closely parallel the pumping curve. This leads to a suspicion that there may be a close relation between rate of industrial activity and water consumption in Dayton. It should be added here that the 1949 pumping was about 5% below the 1948 pumping, and the 1950 pumping is currently running about 3% below the 1949 pumping.

• **HOW MUCH WATER.**—Data have been gathered to measure the amount of water pumping that can be attributed to air conditioning. For example, the new air conditioning added in a year's time that would reflect on the 1948 pumping is estimated to have used 50 million gallons in a year that saw the pumping rise by 1,210 million gallons. Thus, the new air conditioning would account for 4% of the increase. Where did the other 96% increase come from?

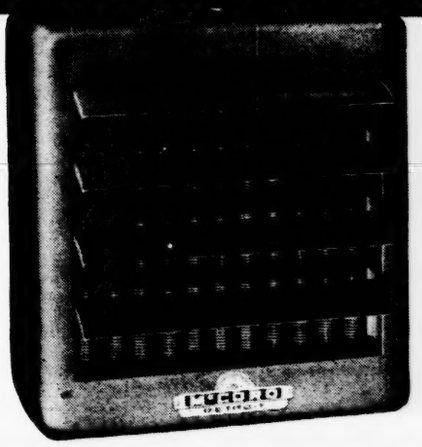
Then there is the matter of how much water per year is used by air conditioning. The best figures that have been compiled so far indicate less than 3% of the total 1948 pumping was used by air conditioning in Dayton. So on the basis of annual water use, air conditioning is a measurable factor. But suppose we relieved the water system of all air conditioning load, would this alone cure the water situation?

• **PEAK DEMAND.** — "In some cases, however," Mr. Gonzalez said, "it is not the total usage, but the peak demand that is important. Here, the data compiled indicate a maximum use of about 9% of the peak day pumping for air conditioning purposes. This sounds very serious—and it may produce heavy demands in

McCORD

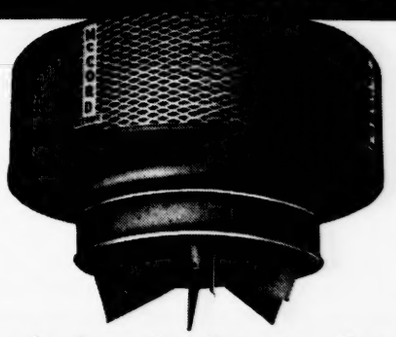
HEATING AND AIR CONDITIONING PRODUCTS

HORIZONTAL TYPE UNIT HEATERS



Modern design—top performance—thousands in use—dependable heat. All copper coils to resist corrosion — individual tube expansion — most rugged construction — quiet operation — easy installation—standard motors with standard bases. Sizes to 272,000 B.T.U. capacity.

VERTICAL TYPE UNIT HEATERS



A proven heating unit—all copper coils to resist corrosion. McCord spiral tube fin construction creates air turbulence without undue restriction. Improved fan delivers large volume of air, with minimum air noise. All McCord heaters are guaranteed for use with 150 lbs. saturated steam pressure. Sizes to 575,000 B.T.U. capacity.

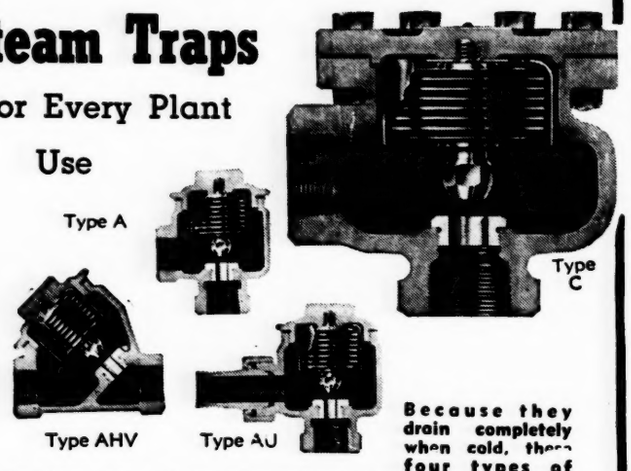
McCORD CORPORATION
DETROIT 11, MICH.

NICHOLSON MAKES

FREEZE-PROOF

Steam Traps

for Every Plant Use



Because they drain completely when cold, these four types of Nicholson steam traps are positively freeze-proof. Can be freely installed outdoors. Universally recommended for use in lines which need not be in continuous use during cold weather, because they are freeze-proof and because their 2 to 6 times average drainage capacity results in minimum heat-up time. The non-air-binding feature of Nicholson traps also notably facilitates steam transfer in severe weather. Size ¼" to 2"; press. to 225 lbs.

BULLETIN 450

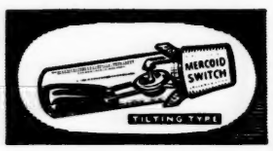
W. H. NICHOLSON & CO. 199 OREGON ST. WILKES-BARRE, PA.

Valves • Traps • Steam Specialties

MERCOID

AUTOMATIC CONTROLS FOR HEATING, AIR CONDITIONING, REFRIGERATION AND VARIOUS INDUSTRIAL APPLICATIONS

THE ONLY 100% MERCURY SWITCH EQUIPPED CONTROLS



The distinguishing feature of Mercoid Controls is the exclusive use of Mercoid hermetically sealed mercury switches These switches are not subject to dust, dirt or corrosion, thereby assuring better performance and longer control life. The items shown below are but a few miscellaneous items. See Catalog No. 700 for the complete line.

Pressure Controls

Temperature Controls

Float Operated Controls

Transformer-Relays.

Low Voltage Thermostats

Line Voltage Thermostats

Liquid Level Control

Oil Burner Safety and Ignition Controls

If you have a problem involving the automatic control of pressure, temperature, liquid level, mechanical operations, etc., it will pay you to consult Mercoid's engineering staff — always at your service.

Manufacturers of Dependable Automatic Controls for Over A Quarter of A Century

THE MERCOID CORPORATION - 4223 BELMONT AVE. CHICAGO 41 - ILL.

localized areas. In Dayton, we were interested in finding out if air conditioning was creating a higher summer peak demand than was experienced, say, 20 years ago. The high months of the 1945 through 1949 years were compared with the high months of the 1925 to 1930 period. Surprisingly, the high months of the 1920 years represent about 10% higher peaks for their years than do the years 1946 through 1949!

"On the evidence of the few years that were tabulated, the high months of the 1925 to 1930 years, when there was practically no air conditioning, represented more of a summer peak than do the figures of 1946 through 1949. In other words, the Dayton pumping has slightly less of a summer peak than it used to have! This indicates that air conditioning cannot, in Dayton's case, be said to be causing an abnormally high summer peak demand. The more we study this problem in Dayton, the more evident it becomes that a larger water system is required by the combined industrial and population growth, and *that essentially the same increase would be required with or without the use of water for air conditioning.* Air conditioning and refrigeration do not stand convicted of increasing the summer peak demand in Dayton because the summer peak demand is actually proportionately less than it was 20 years ago.

• **WATER SAVERS.**— "Getting away from the interesting thoughts suggested by the Dayton air conditioning study, I would like to review briefly the fact that the refrigeration and air conditioning industry has been an outstanding leader in water conservation and water conservation methods. Cooling towers, evaporative condensers and similar water saving devices have been developed simultaneously with all types of air conditioning and refrigeration machinery since the start of the industry. This has come about because water and power are the two basic operating costs in the use of this equipment. In many other uses of water, the cost of water is a minor consideration in the over-all result and hence the possibilities of economizing on water commands a much smaller interest. I would like to stress this one point: Most industrial uses of water lend themselves as readily to water conservation as does air conditioning equipment."

• **HAGERSTOWN.**—Mr. R. C. Willson of Hagerstown, Maryland, another member of the panel, outlined a constructive approach which his city had made to the water problem. Mr. Willson stated that Hagerstown had considered surcharges and other specific measures affecting users of water for air conditioning, but had decided that the best approach was to increase water rates and to charge a sewer rate based on the amount of water used. The exception to this procedure is where air conditioning condenser water is being diverted to a storm sewer. In such instances a separate meter is permitted on this water and no sewer tax on it is charged.

• **WASHINGTON.**—Mr. Roy L. Orndorff of Washington, D. C., also a panel member, presented some enlightening statistics on the water situation in the national capital. He said that, because of projected

expansion of facilities, no unduly-restrictive measures on the use of water by air conditioning installations are anticipated in the future.

In the general discussion following the panel presentations, the subject of water waste had thorough review. One speaker defined water waste as water that has escaped, is paid for, but does not fulfil any useful purpose for the buyer. Mr. Gonzalez expressed the view that there are few uses which actually consume water other than when it is used for drinking and ingredient purposes. He stated that practically all other water is used to carry away some unwanted product and that heat removed by air conditioning is just as much of an unwanted product as dirt, sludge, or other form of waste matter.

NATURAL GAS

to be piped to New England under new FPC order.

In early November the Federal Power Commission issued an order granting certificates of public convenience and necessity to Tennessee, Northeastern, Transcontinental, New York State Natural Gas and Niagara Mohawk Power companies to construct facilities to serve portions of New England and New York with natural gas, with certain specific conditions as to financing and rate schedules.

Tennessee was authorized to construct a 24-inch line from near Buffalo to the Massachusetts border near Pittsfield, to serve intermediate customers, including New York State Natural Gas.

Northeastern was authorized to serve communities in the general areas of western Connecticut as far as Bridgeport, western, central and northern Massachusetts, including Springfield, Worcester, Lynn, Lowell, Haverhill and Arlington, and Nashua, Manchester and Concord, New Hampshire.

Transcontinental was authorized to construct a line from a point in northern New Jersey to the Connecticut border near Greenwich. Both this company and Tennessee will supply gas to Northeastern.

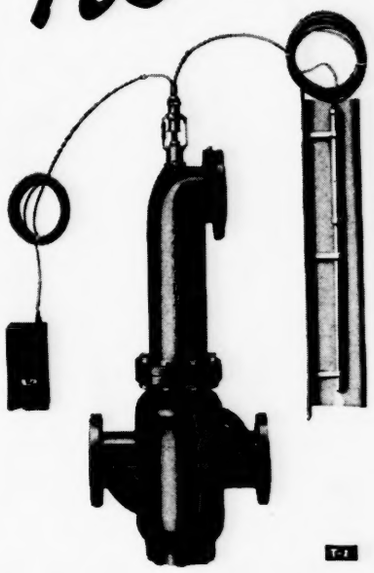
New York State and Niagara Mohawk were authorized to supply gas from the Tennessee line in central New York as far east as the Albany-Troy area.

The Commission proposes to certify Algonquin, if and when it shows adequate gas reserves, to serve other remaining New England areas, including New Haven, Hartford, New London, Providence, Fall River, Boston and Cambridge.

• **HOW MUCH.** — Under the authorizations granted, Northeastern will distribute in New England 156,000 mcf per day to be received from Tennessee and 64,000 mcf per day from Transcontinental, or a total of 220,000 mcf per day. Tennessee is authorized to furnish New York State Natural Gas with 15,000 mcf per day.

Agitation to bring natural gas into New England dates back to October 20, 1947, when Tennessee applied for authority to extend its then existing pipe line from a point in Kentucky to the vicinity of Boston.

It's Here!



THE IMPROVED MODULATING CONTROL for hot water and radiant heating systems

a good product made better—

Sarcotherm engineers are constantly searching for a better product.

While utmost simplicity is still the dominant design principle, the new models now available show many important improvements and refinements.

Double Seated Valves are now used in the larger sizes, greatly increasing valve capacity and permitting smaller valves being used on a given size job. *Convenient manual adjustment* features are now provided in a variety of combinations. *Program control systems* are available to meet any specification.

Easy Installation. New body construction simplifies piping and allows for easy servicing.

Hundreds of successful installations testify to the efficiency of this simple system. Our Engineering Department will be glad to recommend a suitable control system for your particular job.

Ask for new Bulletin ST-501 describing latest improvements.

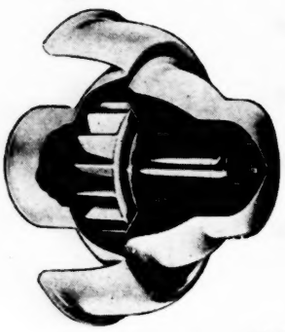
19A

Sarcotherm

SARCOTHERM CONTROLS INC • Empire State Bldg • NEW YORK 1, N. Y.

CUT INSTALLATION COSTS

BEAT THE METAL SHORTAGE
WITH
JENN-AIR WALL EXHAUSTERS



- FASTENS DIRECTLY TO THE OUTER WALL
- NO MOUNTING BRACKETS REQUIRED
- MORE CONVENIENCE AND SHORTER DUCTS
- A COMPLETE PACKAGE UNIT AVAILABLE IN A RANGE OF SIZES

Pats. Pending

ALSO Explosion Proof Models for hazardous locations

A considerable amount of metal duct can oftentimes be saved by exhausting through the outer wall. In addition to this economy feature, you will marvel at the more attractive appearance of the shorter duct system.

It will pay you to investigate the JENN-AIR for your fume and smoke removal problems.

JENN AIR PRODUCTS COMPANY
ARCHITECTS & BUILDERS BLDG
INDIANAPOLIS 4, IND.

D.I.P. Solves UNDERGROUND & EXPOSED PIPING PROBLEMS

REG. U. S. PAT. OFF.

When architects and contractors have difficult insulating problems in the conveyance of steam, hot water, or refrigerants, they most often find the answer in DURANT INSULATED PIPE.

Because the positive protection is always dependable and the non-porous asphalt is completely waterproof, D. I. P. will not lose efficiency with the passage of time. This long service dependability with its low maintenance costs adds to the over-all economy of DURANT installations.

If you do not have complete catalog information and engineering data on DURANT products and processes, we will send them on request — or you can secure them through our representatives located in principal cities over the entire country.

PRE SEALED

REG. U. S. PAT. OFF.

DURANT INSULATED PIPE COMPANY
1015 Runnymede St. East Palo Alto, California

However, in April, 1948, Tennessee, recognizing that its gas supply would not warrant an extension to New England at that time, amended its application to eliminate the proposed line from Buffalo east. Northeastern filed its application for authority to serve New England August 24, 1949.

CIVILIAN HOSPITAL CONSTRUCTION

proceeds at record volume, and current needs would maintain present rate for 15 years.

A notable development in public-works construction during the past two years has been the strong upsurge in construction activity to provide needed civilian hospital and institutional facilities, according to the Construction Division of the Office of Industry and Commerce. Outlays in 1949 for projects of this type more than doubled the previous year's total to top the half billion dollar mark, an all-time record in terms of dollars spent and a near-record in terms of physical volume of facilities added. Hospital construction during the first eight months of 1950 has continued to expand, although at a somewhat slower rate. A big stimulus to the late-starting hospital construction recovery is the additional activity generated by the National Hospital Program, the Federal-aid construction program set up by the Hill-Burton Act of 1946, and administered by the Public Health Service of the Federal Security Agency.

Despite the high level of activity recorded in recent periods, available data on hospital and institutional requirements suggest that a further expansion in the going rate is necessary. Public Health Service estimates of the number of additional hospital beds needed to provide adequate facilities in all areas indicate that the comparatively high current level of hospital construction will have to be continued for a long period of time in order to meet even estimated immediate needs.

• **LEVEL.**—Civilian hospital and institutional construction activity, which recorded its first significant postwar expansion during 1948, more than doubled in 1949 to reach a new record of $516 million. This 1949 total, which excludes expenditures on Veterans' Hospitals, compares with an average yearly outlay of $132 million in the 1920's and $109 million in the 1930's. However, when allowance is made for the sharp upturn in construction costs during recent years, the 1949 hospital construction performance is somewhat less impressive. In terms of 1939 prices, the volume of new hospital and institutional plant added during 1949 was exceeded in 1930 and was only moderately above the average annual rate for the four-year period, 1928-32.

Work accomplished during the first eight months of this year (exclusive of Veterans' Hospital projects) totaled $468 million—a larger expenditure than was made for this class of construction in the entire six-year period ending in 1945. Work on privately-owned projects has accounted for much of the increase in

1950 with January-August activity of $224 million, nearly double the comparable total for the same 1949 period.

• **FEDERAL AID.**—Much of this expansion during the past year and a half resulted from new facilities being built under the National Hospital Program. This Federal-aid hospital construction program makes provision for Federal assistance to the states of $150 million annually. Each state distributes its apportioned Federal money according to the state's own formula within the one-third to two-thirds limits for Federal share fixed by the 1949 amendments to the original legislation setting up the program. Private non-profit organizations as well as state and local public agencies are eligible to receive assistance in the construction of needed health and hospital facilities under this program.

Construction under the National Hospital Program got under way in volume in 1949, when an estimated $125 million (or nearly one-fourth of all civilian hospital construction activity for the year) was put in place. During the first eight months of 1950, more than one-third of all hospital and institutional construction activity was on National Hospital Program projects. By the end of June of this year, the program had made provision for 1,368 projects valued at $953 million, involving 65,601 hospital beds and 244 health centers. Of this total, 180 projects valued at $52 million are in operation, while 781 projects estimated to cost $600 million are under construction. The remaining 407 projects for $301 million have received initial approval.

• **NEEDS.**—The geographical distribution of work programmed to date indicates that new projects are being scheduled in the greatest volume in those areas where needs are most acute. Three southern regions (the South Atlantic, and the East and West South Central) account for 37% of all hospital beds needed. Nearly one-half of all beds provided under the National Hospital Program to date are in these three areas. This is in contrast to the situation during the period 1946 through 1948 prior to the inception of the program when these three regions accounted for less than one-fourth of the national total of public hospital construction work started.

Some measure of the adequacy of the current going rate of hospital construction can be secured by relating it to available estimates of the backlog of needed hospital construction which has accrued through years of under-building, war-time restrictions, population shifts and increases, and higher standards of hospital care. According to the latest approved state plans submitted to the Public Health Service of the Federal Security Agency under the provisions of the Federal Hospital Survey and Construction Act, there are 1,118,535 hospital beds in the United States and Territories. This figure excludes beds in Federal hospitals. Of this total, 166,339 beds were reported by the State agencies to be nonacceptable due to factors such as fire and health hazards.

Estimates based on population and bed ratios as prescribed by Title VI of the Public Health Service Act indicate that civilian hospital requirements for

Sh-h-h!

For very, very quiet ventilation

investigate the new

Swartwout Airlift

A completely engineered centrifugal type ventilator for efficient duct exhaust against static pressure

The low operating noise levels required in ventilation equipment for public, commercial and industrial buildings are attained by the Airlift without sacrificing exhaust efficiency.

Powered by perfectly balanced centrifugal type fans carrying NAFM certified ratings, the 14 sizes provide nearly 50 capacity variations by selective use, at the factory, of different fan speeds and motor horse power.

Airlift features an outstanding improvement in ventilator fans and in overall structural efficiency. The streamlined fan bottom forms a smooth path for the air-flow from inlet to blades; close over-lapping of fan and throat eliminates loss of suction effect. Absence of turbulence at fan inlet and in the ventilator's exhaust area is a result of careful engineering that adds to the unit's quietness and effective operation. Be sure to get full details of this low noise ventilator. Write for Bulletin 341F.

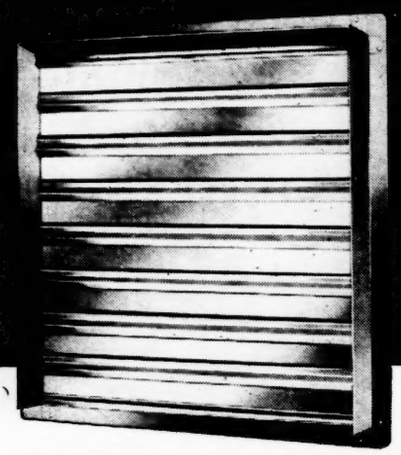
18511 Euclid Avenue, Cleveland 12, Ohio.

The Swartwout Co.

Industrial Ventilation Specialists Since 1904

Equipment for *Controlled* Air Circulation

they all want AIR-FLO



MODEL A-555

THE AUTOMATIC SHUTTER WITH ALL THE FEATURES

Front View—Closed

IT TAKES THE LOAD OFF THE FAN!

Aluminum louvers open fully, permitting capacity fan operation. New heavy reinforcement strip adds strength and long life to the louvers, assures quiet operation and perfect counterbalance, prevents rattling. Deep shroud protects shutter from high winds. Tie-rod, brackets and bearings inside frame, not exposed to weather. Special finish resists corrosion. Many other features.

Write for New Air-Flo Catalog 43-F

Illustrations and details of the complete Air-Flo line.

AIR CONDITIONING PRODUCTS CO.
2340 W. LAFAYETTE BLVD. • DETROIT 16, MICH.

FOR VENTILATION, FUME AND DUST CONTROL

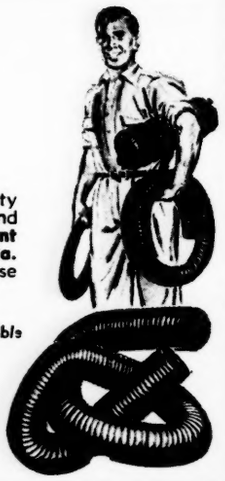
FLEXAUST

SPIRAL-REINFORCED HOSE
LIGHT, STRONG AND VERY FLEXIBLE

Flexaust is of proven suitability for a wide variety of suction and pressure uses in ventilation, fume and dust control. **Extremely Easy to Install—Efficient and Economical in Use. SIZES 1¼" to 24" dia.** Various Flexaust types, accessories, and other hose types also available.

BLOFLEX *Non-reinforced collapsible*

PORTOVENT *Ring-reinforced retractable*

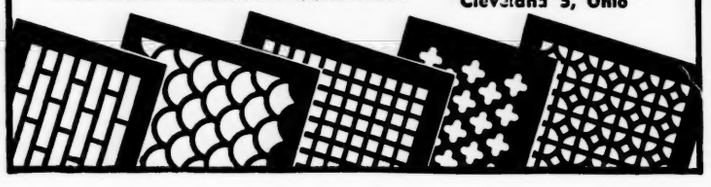


AMERICAN VENTILATING HOSE CO.
Dept. HV-12, 15 Park Row, New York 7, N. Y.
Plant: Amesbury, Mass.
Write for full descriptive data and prices

Auer GRILLES

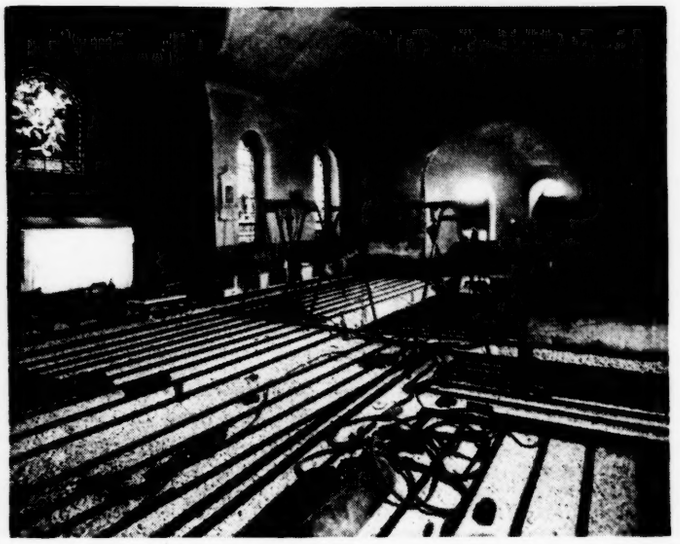
Stamped metal grilles in many designs, sizes to order, for all purposes—air conditioning, ventilating, radiator enclosure, or concealment. In steel (or stainless), aluminum, brass, or bronze. Finished in prime, or special finishes or platings. Catalog "G" shows all designs, with dimensions, opening sizes, full scale details. Sent on request.

THE AUER REGISTER COMPANY 6600 Clement Avenue Cleveland 5, Ohio



the nation reach a total of 1,850,052 beds. This means that an additional 897,856 beds are needed to furnish an adequate supply of hospital facilities. This total represents estimated needs as of the beginning of this year and does not reflect those facilities provided during the first half of 1950 both by construction under the National Hospital Program and outside the Program. However, it is noteworthy that between January 1, 1949, and January 1, 1950, there was no reduction in the total number of net additional beds needed, despite an increase of nearly 73,000 in the number of existing acceptable beds. This was due to state population increases and to the fact that some beds previously classified acceptable were declared nonacceptable in the latest state hospital plan revisions.

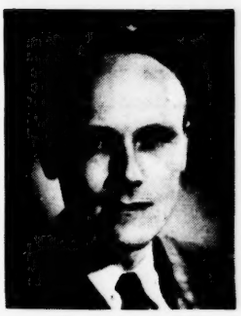
• **PROTECTION.**—Public Health Service needs data are not expressed in dollar terms, but judging from the average per bed cost of the over $900 million worth of work already programmed covering 65,601 beds, the construction outlays necessary to fulfill the remaining civilian hospital requirements at today's construction costs would run over $10 billion, exclusive of estimated land and equipment costs. This figure does not include needs for health centers, clinics, asylums, old people's and orphan homes, and similar institutional building. These types normally account for about 5% of total expenditures for all hospital and institutional construction. In terms of constant prices this dollar volume of requirements is well above the total expenditure by private and public bodies for all civilian hospital and institutional construction during the past thirty years. In relation to the recent going rate it would require twenty years of hospital construction at the 1949 rate to meet current needs, and a fifteen-year program at the apparent 1950 rate.



A 200-year-old church, St. James Episcopal of Monkton, Md., is having a floor-lifting. The old floor, wood planks fastened to hand-hewn timbers resting on the ground, is being replaced by a concrete and brick floor with wrought iron pipes embedded for radiant heating.

• R. H. Weigel, formerly special research assistant, University of Illinois, and co-author of the HEATING AND VENTILATING reference sections reviewing steam and hot water heating research published in September and October issues, has joined the National Radiator Co., Johnstown, Pa., as a senior research engineer.

Getting Personal



F. W. Osborn

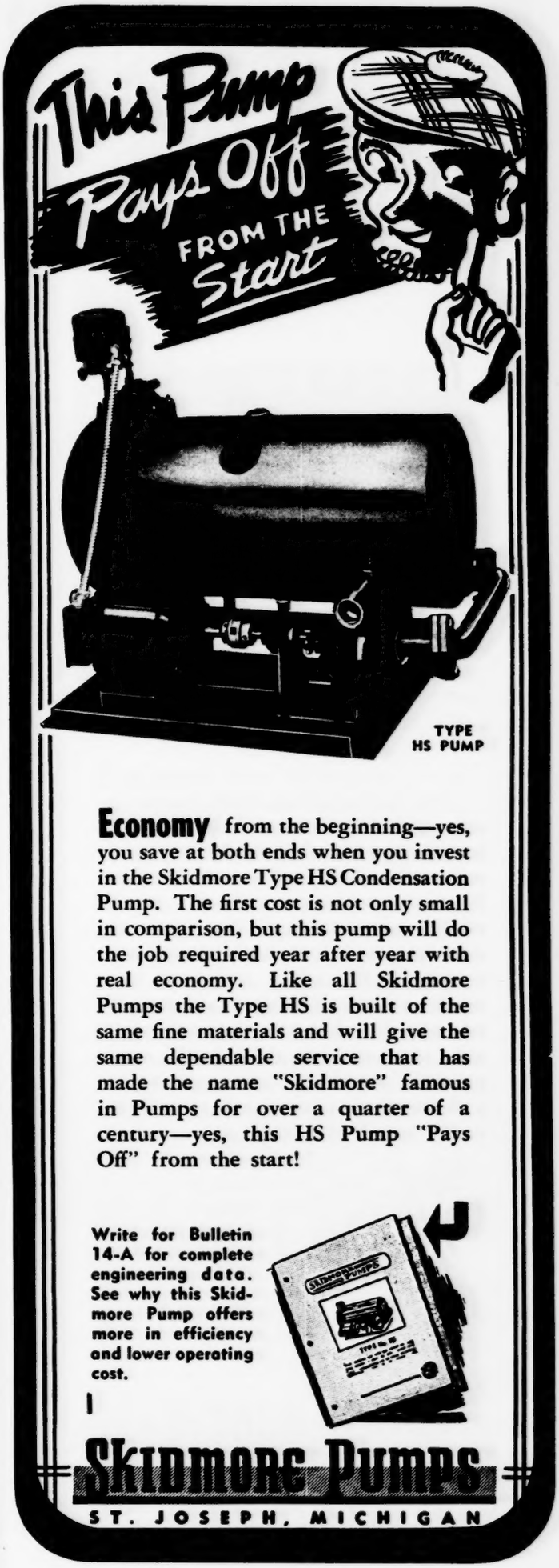
F. W. Osborn *(Warm Air Heating for Schools*, page 67) is an electrical engineering graduate, 1939, of Iowa State College and later obtained his professional engineering license.

Prior to entering the service he was employed in the Engineering Design Department of Newport News Shipbuilding & Dry Dock Co. During World War II he served as a ship construction and repair officer with the U. S. Navy. After his discharge, he affiliated with Minneapolis-Honeywell Regulator Co., in their control division. In 1948 he was employed by The Lennox Furnace Co., as chief application engineer. His present work deals with all phases of the application of Lennox products.

Canadian Degree-Days for September and October, 1950

City	September		October	
	1950	Normal	1950	Normal
Calgary, Alta.	369	432	919	722
Charlottetown, P. E. I.	343	222	589	539
Crescent Valley, B. C.	264	360	707	698
Edmonton, Alta.	346	444	907	747
Fort William, Ont.	378	354	651	722
Grande Prairie, Alta.	366	480	911	812
Halifax, N. S.	294	503	189	499
London, Ont.	220	126	406	508
Medicine Hat, Alta.	295	267	670	601
Moncton, N. B.	384	282	614	595
Montreal, P. Q.	284	180	504	561
North Bay, Ont	388	264	598	694
Ottawa, Ont.	327	204	539	595
Penticton, B. C.	186	213	558	527
Porquis Junction, Ont.	498	396	756	800
Prince George, B. C.	435	444	887	741
Quebec City, P. Q.	339	276	570	651
Regina, Sask.	348	408	764	794
St. John, N. B.	404	270	546	558
Saskatoon, Sask.	366	396	790	781
Toronto, Ont.	172	168	367	504
Vancouver, B. C.	223	234	494	459
Victoria, B. C.	280	264	477	446
Windsor, Ont.	122	54	310	425
Winnipeg, Man.	277	330	628	744

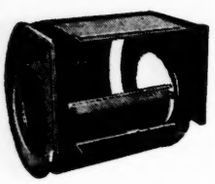
*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

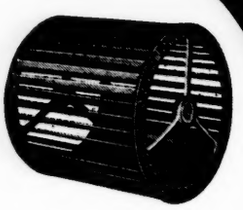

This Pump
Pays Off
FROM THE
Start
TYPE
HS PUMP
Economy from the beginning—yes, you save at both ends when you invest in the Skidmore Type HS Condensation Pump. The first cost is not only small in comparison, but this pump will do the job required year after year with real economy. Like all Skidmore Pumps the Type HS is built of the same fine materials and will give the same dependable service that has made the name "Skidmore" famous in Pumps for over a quarter of a century—yes, this HS Pump "Pays Off" from the start!
Write for Bulletin 14-A for complete engineering data. See why this Skidmore Pump offers more in efficiency and lower operating cost.
SKIDMORE PUMPS
ST. JOSEPH, MICHIGAN

MASSACHUSETTS

BLOWERS

Air Conditioning Furnace Blower Assembly. Designed for manufacturers of warm air furnaces and Air Conditioning equipment. Wheel Sizes 7½" to 27"





Housing Sides—Cutoff Plate and scroll Sheet.

Heavy gauge steel stampings.

End Spider suspension type wheel assembly.

Write for catalogs.

MANUFACTURERS OF CENTRIFUGAL BLOWERS FOR 35 YEARS

MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

4901 HAMILTON AVENUE CLEVELAND 14, OHIO

An Authoritative Reference Book *for*

Heating Engineers—Estimators—Air Conditioning Engineers—Ventilating Engineers—Architects—Piping Engineers—Contractors—Plant Engineers—Operating and Maintenance Engineers

HEATING AND VENTILATING'S

ENGINEERING DATABOOK

Write for Descriptive Folder to
HEATING AND VENTILATING, 148 Lafayette St., N. Y. 13

EFFICIENT, LOW COST AIR REMOVER

Muckle VENTS

POWER DRIVEN ROOF EXHAUSTER

For stores, cafes, bakeries, laundries, garages, etc. Built to function in wet air—motor is out of line of air flow. A compact, sturdy, easy-to-install package unit. Sizes 370 to 13,080 C.F.M. air delivery. Fits any roof. *Write us about YOUR problem.*

MUCKLE MANUFACTURING CO. • OWATONNA 3, MINN.

INDUSTRIAL DEGREE-DAYS
September and October, 1950

City	Number of Industrial Degree-Days			
	55F Base		45F Base	
	September	October	September	October
Baltimore, Md.	10	11	0	0
Buffalo, N. Y.	27	105	3	5
Chicago, Ill.	4	29	0	0
Cleveland, Ohio	11	58	0	0
Detroit, Mich.	19	73	4	2
Indianapolis, Ind. ..	15	43	0	0
New York, N. Y.	12	22	0	0
Philadelphia, Pa.	10	16	0	0
Pittsburgh, Pa.	13	34	0	0
St. Louis, Mo.	0	12	0	0

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) OF HEATING AND VENTILATING, published monthly at New York, N. Y., for October 1, 1950.

State of New York,

County of New York, ss:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the Treasurer of the Industrial Press, Publishers of HEATING AND VENTILATING, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily, weekly, semiweekly or triweekly newspaper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, The Industrial Press, 148 Lafayette St., New York 13, N. Y.

Editor, Clifford Strock, 148 Lafayette St., New York 13, N. Y.

Managing Editor, none.

Business Managers, Robert B. Luchars, 148 Lafayette St., New York 13, N. Y.; Edgar A. Becker, 148 Lafayette St., New York 13, N. Y.; Harold L. Gray, 148 Lafayette St., New York 13, N. Y.

2. That the owner is:

The Industrial Press, 148 Lafayette St., New York 13, N. Y.; Robert B. Luchars, 148 Lafayette St., New York 13, N. Y.; Edgar A. Becker, 148 Lafayette St., New York 13, N. Y.; Franklin D. Jones, 148 Lafayette St., New York 13, N. Y.; Walter E. Robinson, 148 Lafayette St., New York 13, N. Y.; Charles O. Herb, 148 Lafayette St., New York 13, N. Y.; Harold L. Gray, 148 Lafayette St., New York 13, N. Y.; Clifford Strock, 148 Lafayette St., New York 13, N. Y.; Suno E. Larson, 148 Lafayette St., New York 13, N. Y.; Helena E. Oberg, 65-82nd St., Brooklyn 9, N. Y.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; First National Bank and Trust Co. of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank and Trust Co. of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank and Trust Co. of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; Lee W. Urban, Guardian for Susan Yarnall Urban, 27 Clinton St., Oneonta, N. Y.; Lee W. Urban, Executrix of Will of Robert L. Urban, 27 Clinton St., Oneonta, N. Y.; John T. Urban, 224 Sullivan St., New York 12, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

Charlotte B. Baldwin, 420 Clinton Ave., Brooklyn, N. Y.; John Connolly, 148 Lafayette St., New York 13, N. Y.; Franklin D. Jones, 148 Lafayette St., New York 13, N. Y.; Robert B. Luchars, 148 Lafayette St., New York 13, N. Y.; Louis Pelletier, 148 Lafayette St., New York 13, N. Y.; Elizabeth Y. Urban, 38 Lakeview Road, Asheville, N. C.; Helen L. Ketchum, 231 King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; Henry V. Oberg, 3375 Kenmore Road, Shaker Heights 22, Ohio.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Business Manager

Sworn to and subscribed before me this 29th day of September, 1950.

CHARLES P. ABEL,

Notary Public, State of New York No. 24-0002700 Qual. in Kings Co. Certs. filed with N. Y. Co. Clerk, Kings & N. Y. Co. Registers. Term expires March 30, 1951.

Bind in

AIR CONDITIONING DESIGN CONDITIONS – INDUSTRIAL PLANTS

(Abstracted from a survey by Nathan N. Wolpert, Associate Editor, HEATING AND VENTILATING)

Abrasives

In the manufacture of abrasive grinding wheels, an attempt is made to hold the room temperature to 78F and 55% R. H.

Baking

Steam is delivered to bread ovens at 5 to 15 lb pressure. The air conditioning equipment installed not only filters but washes the air and this holds down the dust particles carrying mold spores. In some plants, cakes are passed under ultra-violet rays to sterilize the baking product from mold spores before wrapping. Table 1 presents temperatures and humidities used in various stages of baking and the storage of supplies.

TABLE 1—AIR CONDITIONS FOR BAKERIES

Room or Process	Temperature, F	Relative Humidity, %
Storage		
Flour	70 - 75	65
Yeast	40 - 45	60
Milk and sugar	45 - 55	60
Shortening	50 - 55	60
Canned goods	40	60
Fresh fruits	35	60
Eggs	35	50
Waxed paper	50 - 60	
Ingredient water	34 - 38	
Bread dough in mixers	78 - 80	
Fermentation room	78 - 82	75
Make-up room	82 - 84	65
Proof box	95 - 98	80 - 85
Bread cooling	80 - 85	75
Bread wrapping	65	65
Cake mixing	70 - 75	
Cake mixing—sponge type	95 - 110	
Bread ovens	375 - 450	
Cake ovens	300 - 430	

Brewing

While the variables of physical location, equipment, raw materials and processes all affect the conditions in any one brewery, average figures for steps in brewing are given in Table 2, furnished by one authority.

Wort is cooled after removal from kettle in the coolship and open cooler room. Here the air may be heated to between 90-110F to reduce the relative humidity to promote evaporative cooling. Air to the fermenting cellar must be filtered if fermentation is carried on in open tanks. Filtered air is also supplied to the room for storing liquid yeast and to the coolship and open cooler room. It is not required for the other processes.

The following representative data on air conditions in various departments of a brewery were supplied by another authority. For fermenting cellars, temperature should be 38-50F and the relative humidity, 60-85%; bacteriological control is desirable. For storage and finishing cellars, temperature should be 30-34F and relative humidity 60-85%; bacteriological control is desirable for rooms with open tanks. While of less importance in rooms with closed tanks, it is still favored as a means of controlling mold growths on ceilings and walls. Low humidity and dust control are important where malt and other grains are ground and where materials are handled.

TABLE 2—AIR CONDITIONS FOR BREWING

Room or Process	Temperature, F	Relative Humidity, %
Fermenting cellar		
Lager	40 - 45	75 min.*
Ale	55	75 min.*
Storage cellar		
Beer or ale	32 - 35	75 min.†
Racking cellar		
Keg filling and storage	32 - 35	75 min.
Hop storage	30 - 32	55 - 62 70 max.
Liquid yeast storage	32 - 34	
Grain storage—When storing for considerable period	80 or less	60 or less

*If wooden tankage is used, relative humidity must be 75% min.; otherwise humidity is maintained to prevent condensation on walls and ceilings.

†If wooden tankage is used.

Candy

Data on conditions maintained in confectionery plants are given in Tables 3 and 4—each based on data from a different source.

Dust control is employed for handling starch. Ventilation systems are installed to remove heat and vapor from many of the candy furnaces. The use of bacteriological control is increasing and some candy companies employ outside firms that specialize in such sanitation.

While Table 4 and information in the following paragraphs may vary with the preceding data, a study of the combined figures may help to arrive at suitable air conditioning design conditions.

This second candy authority states that jellies and gums are cast into starch molds and are dried in air conditioned hot rooms maintained at 120-140F. While humidity is important (13-19% R.H. for temperatures given) close control is not necessarily needed, since a large amount of personal experience governs the drying procedure.

Cooling tunnels are employed in the cooling of cast chocolate bars, coated centers, and hard candy. Basically, this tunnel is a long insulated box placed around a conveyor in such a manner that the product travels through it. Cold air is supplied at the end of the tunnel at which the product leaves so as to utilize the counterflow principle for the cold air. In general, air is supplied at velocities up to 1,500 fpm and at temperatures of 35-45F. The high air velocity creates a turbulent condition in the tunnel to promote better cooling. In chocolate enrobing, the aim is to secure

an even chocolate with some luster. Since the best luster is obtained with rather slow cooling, a slow production rate must be followed or excessively long cooling tunnels used.

Although most finished goods will keep at conditions shown in Table 4, special attention must be given to nuts so that excessive dehydration of the nuts is avoided, mold growth is retarded, and insect eggs are kept dormant.

Starch or sugar dust is normally picked up by the return air of the cooling cycle and accumulates with condensed moisture on the cooling coils. This reduces the cooling capacity of the coil and provides a maintenance problem. Therefore, the use of filters is recommended for both outside and return air.

TABLE 3—AIR CONDITIONS FOR CANDY MANUFACTURE
Prescribed by Source A

Room or Process	Temperature, F	Relative Humidity, %
Chewing gum		
Manufacture	77	33
Rolling	68	63
Stripping	72	53
Breaking	74	47
Wrapping	74	58
Hard candy		
After drops are formed	60	40 - 60
Cooling, mixing, packing	75 - 80	40 - 45
Chocolate		
Candy centers for coating	75 - 80	
Hand dipping	63	45
Packing	68	45
Finished cholocate storage	55	50
Nougat, fudge, caramel, toffee		
Panned specialty rooms	70 - 75	45
General candy storage	65	45
Nut storage	50 - 55	50

TABLE 4—AIR CONDITIONS FOR CANDY MANUFACTURE
Prescribed by Source B

Room or Process	Temperature, F	Relative Humidity, %
Hand dipping	60 - 65	50 - 55
Enrober room	75	60
Jellies and gums—drying	120 - 140	13 - 19
Cooling tunnel	35 - 45	
Packing		
Chocolate	65	55
Hard candy	70 - 75	35 - 45
Storage		
Finished candy	70	40 - 50
Nuts	30 - 32	75 - 80

Ceramics

Comfort for the worker is the chief cause for temperature control in the ceramic industry, although exact temperature conditions are important where decalcomania are transferred onto whiteware.

In the refractories industry, temperature can range from a comfortable working temperature of about 65F to whatever the maximum summer temperature might be — 95 or 98F. Relative humidity does not have to be controlled for it has no effect upon the product. However, dust control is important and the dust count must be held down to 4 million particles per cubic foot due to the danger of silicosis. Since the material might contain over 9% free silica, the dust content must be controlled.

In the manufacture of whiteware, air temperature is not important in most departments except as it affects the comfort of the men. One of the several spots in the whiteware plant where temperature must be controlled is the decorating shop. Here, where paper is used to transfer patterns from a machine or decalcomania onto ware, reasonable temperature and humidity controls must be exercised. Otherwise the paper will contract or expand to interfere with color registration on the ware. Another critical spot where temperature and humidity control is mandatory is the decalcomania production room. Because temperature and moisture affect the size of the paper backing, it also governs registration of colors.

Conditions in the enamel industry are about the same as in the pottery field. Temperature is controlled only for the comfort of the men. Although relative humidity is an important factor in the firing, up to this time no one has done anything to control it. Dust control is necessary because of the inherent danger due to silicosis and because of the possible damage that dirt can do to porcelain enameled steel used in refrigerators and appliances. Much of the air in enamel plants is filtered before it enters the rooms where spraying and particular handling is done.

In glass plants conditions are about the same as in the whiteware plants except that some precautions are taken to control the heat in the machine room where glass bottles and ware are made. Generally this is done by blowers to establish proper air movement in the factory. The dust count must be held down due to the possibility of silicosis.

Cigars

Air conditions to be maintained in the manufacture of cigars are listed in Table 5.

TABLE 5—AIR CONDITIONS FOR CIGAR MANUFACTURE

Room or Process	Temperature, F	Relative Humidity, %
Packing and shipping	76	65
Cigar making (machine)	76	73
Tobacco stripping (machine)	75	75
Wrapper tobacco conditioning and storage	75	75
Filler tobacco storage and preparation	78	70
Filler tobacco casing and conditioning	75	75

(To be continued)

Quiet, Efficient Performance

ANNOUNCING Type NH Fans *for Ventilation, Air Conditioning, and Industrial Services*

A new line of fans with the same **HEAVY-DUTY** construction found in all Clarage equipment! . . . and with **money-saving advantages,** compared to older, less modern designs.

1. Operating speeds that allow the selection of relatively high speed motors, resulting in reduced motor and drive costs.
2. A full self-limiting horsepower characteristic permitting the use of smaller motors with safety — **another economy** in over-all installation costs.
3. Engineered for quiet, efficient performance, Clarage Type NH Fans are **more than O.K.** no matter how exacting your job.

Write us for Bulletin 220. It will pay you to know about this newest Clarage development.

CLARAGE

—HEADQUARTERS for Air Handling and Conditioning Equipment

CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN

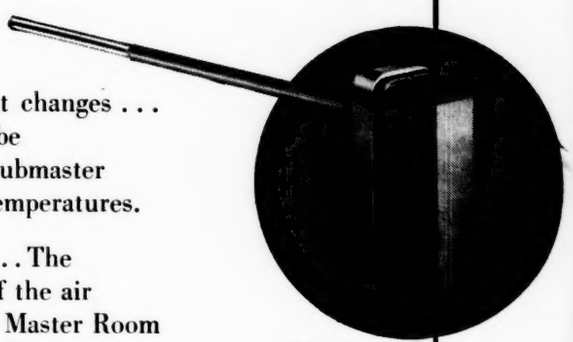
APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

the Right way to control Unit Ventilators . . . the JOHNSON "Master-Submaster" method

T-460
Johnson "*DUAL*" Master
Room Thermostat

HERE ARE THE ADVANTAGES—

- **Stable discharge temperature** . . . The controlling element is located directly above the heating coil. The results—
  CONSTANT SPACE TEMPERATURE — NO DRAFTS
- **Quick response to variations in steam pressure** and other influences which ordinarily produce unstable control.
- **Minimum deviation in room temperature** when the demand for heat changes . . . A Johnson Master Room Thermostat of high sensitivity can be employed because, operating through the Johnson Submaster Airstream Thermostat, it cannot produce "hunting" discharge temperatures.
- **Both high and low limits** of the discharge temperature are provided . . . The Submaster Airstream Thermostat controls the temperature of the air discharged by the unit between those limits, as directed by the Master Room Thermostat. (When a Johnson "*DUAL*" Room Thermostat is used, as illustrated, it controls at reduced temperature during non-occupancy periods.)



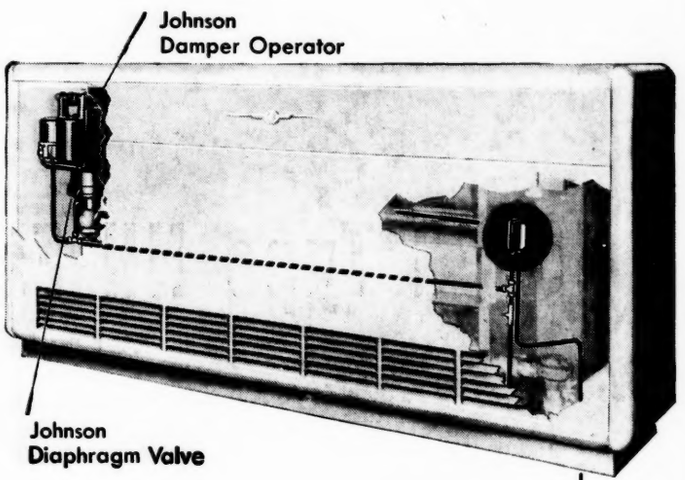
T-325
Johnson Submaster
Airstream Thermostat

OPERATING CYCLE—

During the "warm-up" period, the unit delivers air which is heated to the maximum possible temperature. As the room approaches the desired temperature, the Johnson operator opens the outdoor air damper to a fixed minimum position and the Johnson valve on the heating coil throttles.

If the room tends to overheat, the valve closes and the outdoor air damper gradually moves to its maximum open position.

The automatic switch on the Johnson damper operator closes the outdoor air damper when the unit is not in operation.



Ask a Johnson engineer from a nearby branch office to explain Johnson "Master-Submaster" Control in more detail. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

DESIGN · MANUFACTURE · INSTALLATION · SINCE 1885